July 1963

culture

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Saw-toothed Grain Beetles . . *M. T. Armstrong and R. W. Howe*
Teaching Animal Husbandry in the U.S.A. . . . *T. G. Boaz*

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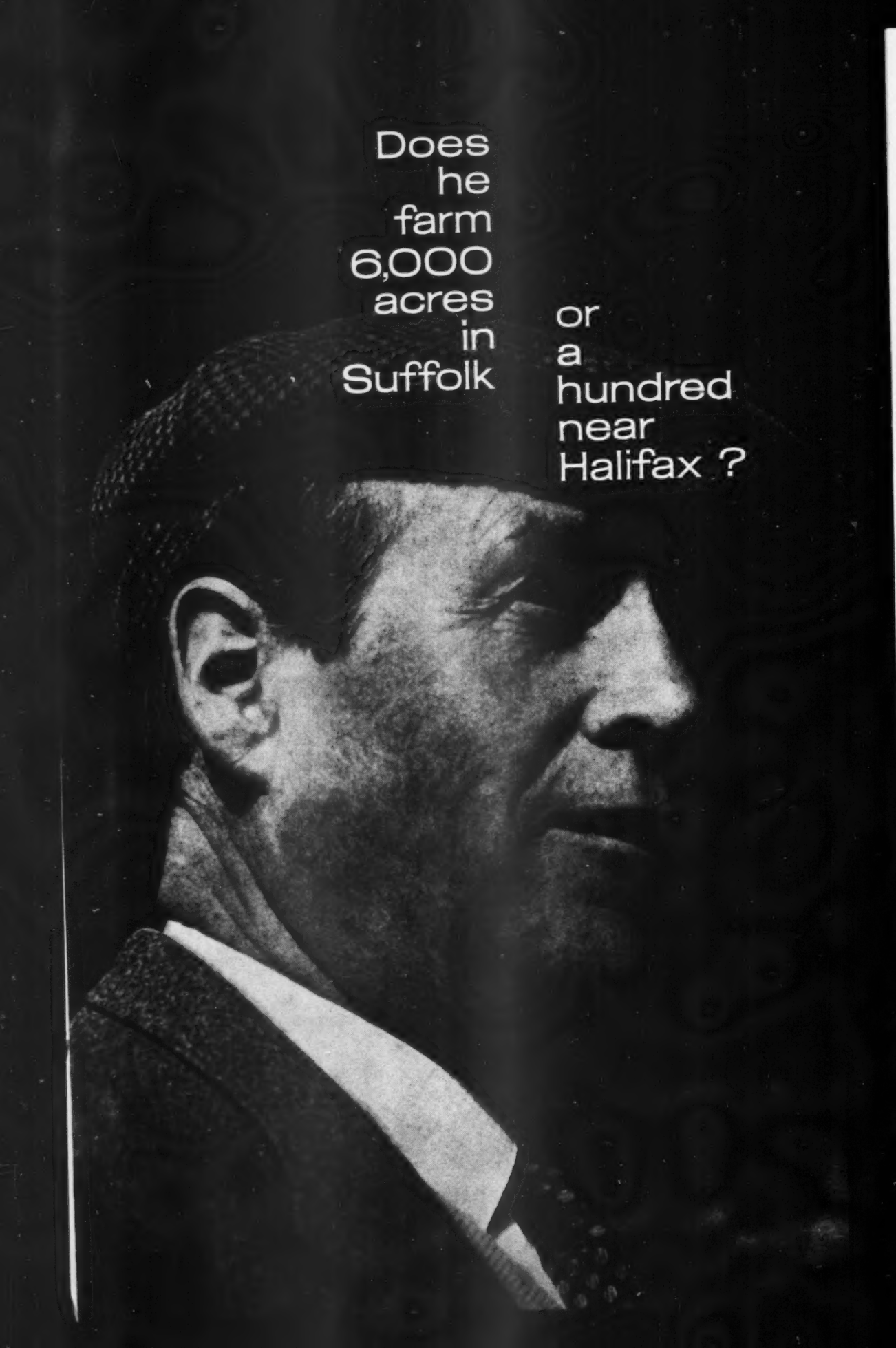
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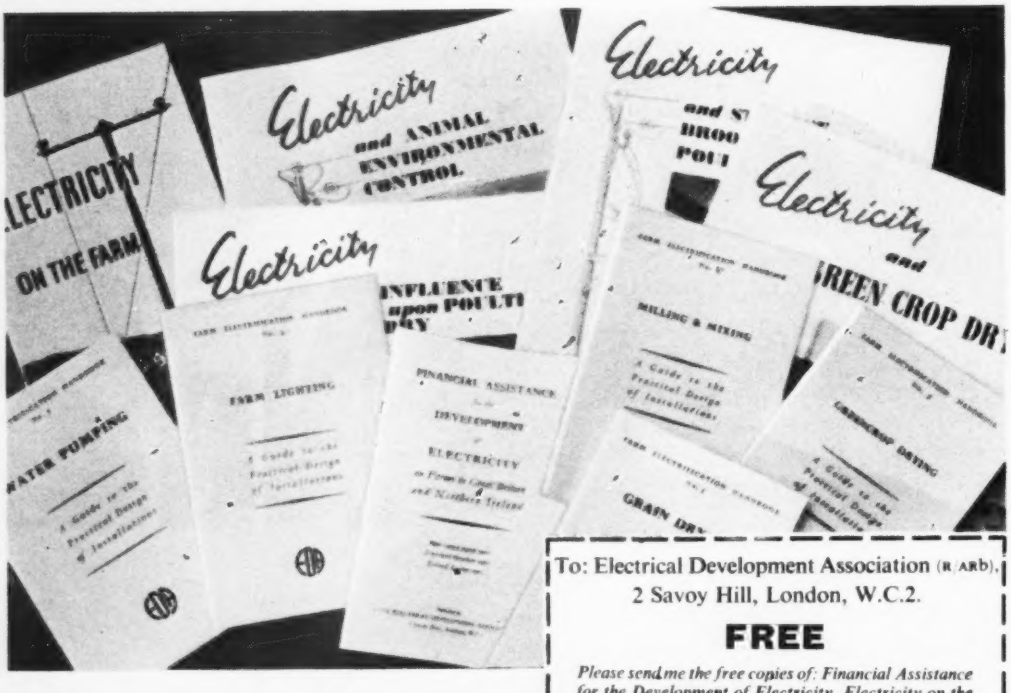

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Agriculture

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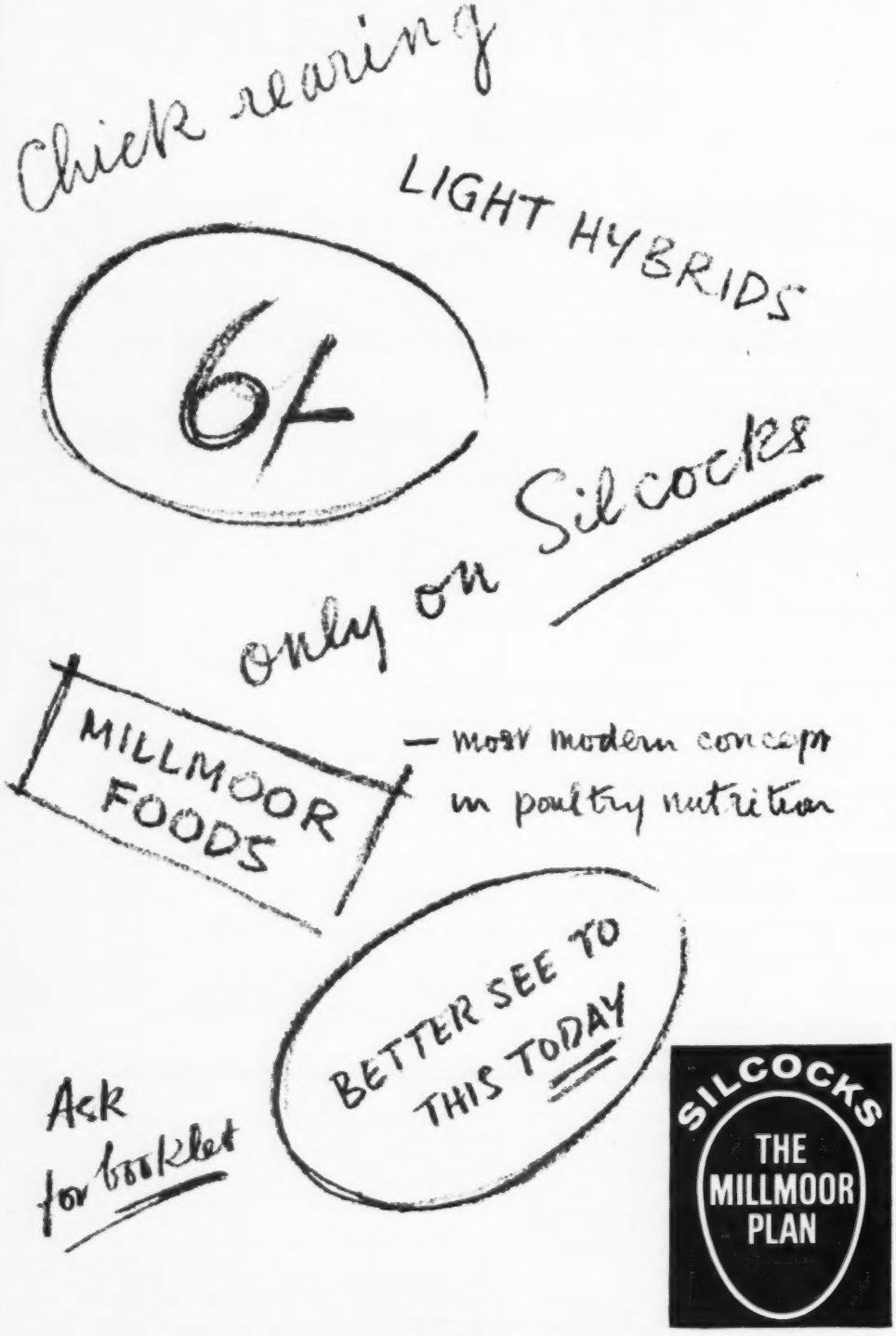


R. Silcock & Sons Ltd., Stanley Hall, Liverpool 3.

These double 22 ft-span mobile glasshouses at Stockbridge House were cropped with tomatoes in May. In the foreground is a protected site for mid-season chrysanthemums and self-blanching celery. This site was recently vacated by lettuce. Each house moves over three sites. The celery will not be covered

MOBILE GLASS

It is more than ten years since the mobile glasshouse emerged in its modern form, as a house built on rails which runs over small wheels instead of having wheels attached directly to the house. This basic change put the mobile glasshouse on to a practical footing, and any changes made since have simply been refinements in design. A good deal of experience has, nevertheless, been gained in the use of mobile glasshouses, and perhaps also in their limitations. If the vision of a complete swing to mobile glass by the glasshouse industry has been shattered, the more solid advantages of mobility have been firmly established.

Mobile glass offered an opportunity for rotational cropping of glasshouse soils while still allowing the tomato crop to be grown annually in the house. This opportunity came at a time when advancements in other fields have done most to permit mono-culture to be practised, both in agriculture and in horticulture. Although even short rotations are helpful, a rotation long enough for tomatoes cannot be provided by any practical number of alternative sites for a mobile glasshouse. The level of protection which short rotations give cannot usually match that provided by other means of controlling soil-borne pests and diseases—as in the case of the tomato crop,

steam, chemicals or disease-resistant rootstocks, although the latter may yet prove of value in conjunction with short mobile house rotations.

The mobile glasshouse emerges primarily as a labour-saving device to be used particularly in connection with those crops which spend part of their growing season in the open and part under cover. This applies particularly to bulb crops, freesias and chrysanthemums, where it is obviously advantageous to be able to move the house over the crop, rather than carry the crop into the house. It is with these crops that the mobile glasshouse has already become a firmly established horticultural appliance.

Progress has been more tentative, if not actually tardy, in the use of mobile glass to establish crops which are later to be uncovered to mature in the open. It is comparatively simple to decide when a crop should be covered by a mobile glasshouse, but greater skill is required in deciding when to uncover a crop and also in preparing a crop for this event. Unheated mobiles are more suited to this purpose because obviously the difference between the protected state of the crop and the unprotected state is smaller. The mobile glasshouse must inevitably replace the frame in the Dutch light system of cropping, particularly in relation to the unheated house lettuce crop.

It is fairly safe to predict that the future mobile will move away from the Dutch light type of structure to a house which at once lets in more light and is more airtight. It should also be of lighter construction and therefore easier to move.

The mobile glasshouse is inevitably bound up with short-duration crops, so there seems little point in constructing tall houses with wide spans which, because of more complicated roof truss requirements, are inevitably more expensive. At one stage the wide span seemed important in order to avoid a proliferation of wheel-bearing dollies which obstruct the mechanical cultivation of mobile glasshouse sites, but this difficulty has now been overcome by the use of the chisel plough and the rotary cultivator which permit the soil to be cultivated close to such obstructions. Used together, they provide a reasonable standard of mechanized soil preparation.

F. G. Smith

Director, Stockbridge E.H.S.

Congratulations

To **Major E. S. Dobb,** Director of the Agricultural Land Service, on the award of C.B. in Her Majesty the Queen's Birthday Honours List.

The versatility of modern auger-conveying systems is giving a new-look to cereal harvesting

Progress in Bulk Handling of Grain

Claude Culpin

SOONER or later nearly all grain will be handled in bulk, both on and off the farm. Adoption of bulk handling is now proceeding fast, and it is no longer necessary in a journal such as *Agriculture* to point out the many advantages of such techniques. The most recent census figures show that the days of the bagger combine are numbered, and most thinking farmers are now concerned primarily with deciding which are the best of the many bulk handling methods for their conditions.

One reason why bulk handling is catching on is the portable grain auger. Even in their simplest form, augers have proved capable of simplifying and cheapening bulk handling procedures to a remarkable degree, and recent developments include machines which will not only keep grain moving in a single direction but will also take it round corners. Such is the adaptability of augers that grain in bulk can now be handled quite effectively without either digging large holes in the ground or erecting bulk hoppers high overhead. This does not mean that bucket elevators and conventional grain pits are obsolete, but augers greatly widen the choice of handling methods.

Transport from combine to store

The trend towards bulk handling has been accelerated by the advent of combine harvesters with much higher outputs than the two tons per hour which was normal only a short time ago. Today, outputs in the region of 4–6 tons per hour are becoming common, but manufacturers have taken some account of the transport problem by providing grain tanks of about

30 cwt capacity, so that 15–20 minutes is still the normal time taken to fill the tank. But augers of high capacity are provided for emptying the combine's tank; typical times are only 1–1½ minutes.

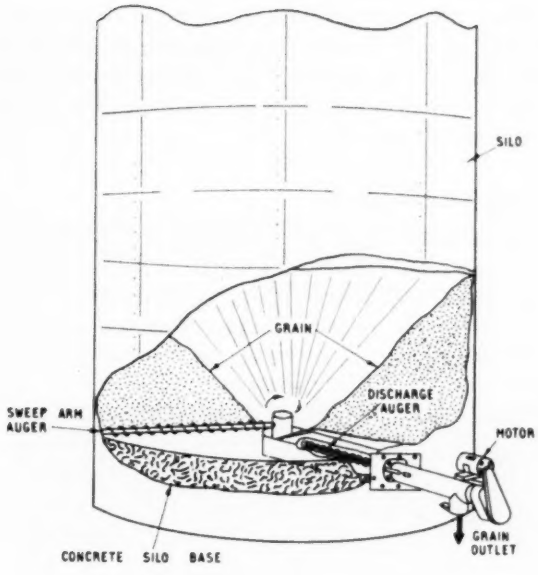
Thus, if two high-output combines are working together, and no hitch occurs, it is just possible for a single tractor and trailer or lorry of 3–4 tons capacity to keep them going, provided it does not spend more than about 15 minutes on the round trip to the store. This means that if emptying at the store does not take more than about 3 minutes, and average speed is 10 m.p.h., the combines should not be held up unless the distance between the store and the combines is more than about one mile. Such perfection of operation is, however, difficult to achieve in practice, and it is always advisable to provide facilities for the combines to empty their tanks should the transport be held up.

When a single combine of moderate capacity works alone, the transport problem is similar in essentials, in that the combine's tank needs to be emptied every 15–20 minutes, and time will be lost if the transport equipment is not there. In practice, though the aim of keeping the combine working for as high a proportion of the available time as possible should not be lost sight of, there has to be some compromise over transport cost.

A reasonable solution on many farms is to provide two trailers and one tractor for transport, one trailer being set down in the field. The combine delivers one or two tank-fuls into the stationary trailer, and when the transport tractor comes along the rest of the load can be taken in on the move. With such a system the combine's working time may be cut by about 5 per cent, but the driver of the transport tractor has ample time to empty his load and attend to various jobs about the buildings, and a two-man harvest is quite practicable.

There are, of course, many variations which may be worth considering in particular circumstances. Modern augers are so effective that it is not even essential that any 'set-down' trailers should be self-emptying. Almost

The high-capacity portable auger being used here to fill outdoor silos from a tipping trailer can also be used to fill a bulk transport vehicle. The grain is removed from the flat-bottomed silos by a combination of sweep and horizontal augers



The diagram shows how high-moisture grain can be removed from a 'sealed' silo by a combination of a sweep arm and a fixed horizontal discharge auger. When wet grain is stored, the grain outlet must be sealed at all times, except when the auger is in use

any sort of trailer will do, since cracks can easily be covered with a cheap plastic sheet. Temporary storage in the field can even be improvized by making a box of straw bales and lining it with a polythene sheet. This is not usually as attractive as using trailers, since picking the grain up again requires an auger driven by means other than an electric motor. Engine driven, p.t.o. driven and hydraulically driven augers are available, but they are normally used only where electric drive is out of the question.

Obviously, the higher the combine capacity and the greater the acreage to be harvested, the more important it is to ensure that the combines are not held up for lack of transport; on very large farms at least two transport vehicles should be provided.

Unloading at the store

The importance of a quick turn-round at the store when high-capacity machines are at work has already been made clear. Rapid emptying is possible if the load can either be tipped into a large pit or on to a barn floor. But the problems should not be exaggerated. On a typical medium-sized farm, growing, say, 300 tons of corn, a high-output combine would be an unjustified luxury. A machine with a normal capacity of 3–4 tons per hour should be adequate, and it will have plenty of time to complete the harvest if it delivers part of the corn into a stationary trailer. The transport driver need only return to the field about every 40 minutes, and he has plenty of time to deliver the corn into bins or on to a drying floor if the conveying system has a capacity of about 10 tons per hour. On such farms, slow-drying ventilated systems score, because everything except the drying fan can be switched off before the transport driver returns to the field.

On many farms where small continuous driers or batch driers were installed some years ago, corn production has increased, and the bagger combine has now been replaced by a tanker. Drying capacity may still be adequate, provided it can be fully utilized. The need is to provide improved

grain reception facilities, together with pre-drying bulk storage. Only a few of the many ways of tackling such problems need be mentioned. Where there is room, high-capacity bucket elevators and one or two self-emptying bins are ideal. In other circumstances it may be possible to increase pre-drying storage by using a flat area adjacent to the pit.

New types of bulk handling installations

Where a new store is being planned, bulk handling systems which are worth consideration alongside the better known bin plants include a system of drying and storing on a flat floor, and the use of outdoor cylindrical bins which can be emptied almost completely by sweep auger. The outdoor bins are both filled and emptied by augers, which can easily be transferred from one bin to another, so saving on capital cost of conveying equipment.

Similarly, where a floor storage system is used, the basic handling equipment is usually either a pair of small augers or one large trolley-mounted auger; and these may be assisted by additional small augers where a merchant's bulk transport has to be loaded quickly. Recent developments include drag augers, which have an open horizontal section connected to the main part by a universal joint.

Loading the merchant's transport

For large installations there is still much to be said for elevated hoppers which can empty by gravity directly into the merchant's vehicle. This is quickest and simplest, but not usually cheapest. The modern trend is to make use of a high-speed conveying method, sometimes in conjunction with a holding bin. An 8-inch auger, dipping into an ordinary silo, can easily give a conveying rate of about 30 tons per hour, and it costs less than an elevated hopper.

Where bucket elevators are used in conjunction with a deep pit, it is often practicable to use a pair of elevators to provide a delivery rate of about 20 tons per hour. If the bottom conveyor has a similar capacity, there is no need to move grain beforehand into a holding silo, and the high-capacity conveying system makes it easy to turn the grain when necessary.

Likely trends

It seems likely that developments during the next few years will be in the direction of bulk handling systems which are flexible and low in capital cost. There is a healthy tendency not to insist on handling systems which are fully automatic. If capital cost can be saved by moving an auger, it is not likely to be worth while on most farms to spend money unnecessarily on fully 'press-button' types of installation.

It will be a long time before the last of the bagging combines are scrapped, but there will be few farmers who will deliberately choose to handle grain in sacks by 1970.

Claude Culpin, O.B.E., M.A., has been the Ministry's Chief Farm Machinery Adviser since 1948. From 1933–40 he was lecturer in Agricultural Engineering at Cambridge University. He was County Agricultural Organizer for Worcester during the war, and then became Agricultural Development Engineer with a large industrial concern before joining the N.A.A.S. in 1947. A well-known lecturer, he has also written several books, among them *Farm Machinery* (now in its 6th Edition) and *Farm Mechanization Management*.

For land-using livestock enterprises such as beef and sheep, margin per acre is often a more satisfactory measure than margin per head

Brian Davey

PER HEAD or PER ACRE?

PROFITS from livestock enterprises are frequently expressed in terms of profit per head, e.g., per bullock reared or per pig sold. But such a yardstick does not take account of the acreage of land used by the stock. There are, of course, other important issues besides land affecting farming decisions such as capital and labour, but these aspects do not come under consideration in this article.

What exactly do people mean when they talk about profit per head? It is unlikely that they mean the true profit per head after all the costs of production including labour, rent, depreciation and other fixed costs have been set against the output of the enterprise, since few farmers keep the records necessary to calculate such a figure. They are more likely to be referring to the producer's margin per head (i.e., the difference between the price received for the sale product and the cost of the store animal) or perhaps the margin over feed costs incurred in bringing the animal to slaughter weight.

Profit per head misleading

But whilst margin or profit per head is a satisfactory measure of profitability for such intensive livestock enterprises as pigs, poultry or barley beef production, it is by no means as satisfactory for the land-using enterprises beef, sheep and dairying. The area of grassland and other forage crops used by the stock must also be taken into account. Management decisions based solely on margin per head can be misleading, as will be shown later.

A better measure of profitability for land-using livestock enterprises in general is the *gross margin per acre*. This is particularly the case when farmers are thinking of changing the organization of their farms. Here the gross margin per acre, rather than margin per head, enables a direct comparison to be made between alternative enterprises and systems of production.

For the purposes of this article it has been assumed that land is the most limiting factor to the expansion of a farm business. This is the case on all but very few British farms; most farmers when asked what they would most like more of would reply—'land'.

The gross margin per acre is the difference between the output from the enterprise and the variable costs of production (e.g., feedingstuffs, veterinary bills and medicines) and the variable costs (e.g., fertilizers, seeds and sprays) of the forage crops consumed by the stock, divided by the acreage of forage crops (grazing, hay, silage, kale, mangolds, etc.), used by the stock in any one production period. The following examples will show why the gross margin per acre is often a more useful measure of the profitability of land-using livestock enterprises than margin per head.

Take a beef enterprise

Consider the typical gross margins per head and per acre for various systems of beef production shown below.

Beef Production: Gross Margins per head and per acre

System of Production	*Gross Margin per head* £	*Acres per head*	*Gross Margin per acre* £
Forward stores bought in spring for summer fattening	10·3	1·4	7·3
Calves bought in autumn, early weaned and sold fat at 18 months	23·7	0·8	29·0
Single-suckled herds:			
Autumn calving, fat at 18 months	38·2	2·5	15·3
Spring calving, fat at 21 months	59·1	2·9	20·1
Spring calving, fat at 12–15 months	30·6	2·2	14·0

(Source: Beef on the Arable Farm. P. G. James and R. J. Gayton. Farm Economics Branch Report No. 56, University of Cambridge.)

This table illustrates quite nicely the importance of taking land use into account when calculating the profitability of beef production. The most profitable systems in terms of gross margin per head are the single suckling herds. But these systems are relatively extensive in their use of land and the system of fattening early weaned calves for sale at 18 months, although having a relatively low gross margin per head, has the highest gross margin per acre by virtue of its intensive use of land. The time factor is also important; in the systems shown, for example, the turnover period for the grass fattening system is only 5 months, compared with 15–20 months for the other systems.

Fattening early weaned calves

Not only is gross margin per acre a useful criterion in selecting particular systems of beef production, it is also a good means of choosing between alternatives within a system. Let us take as an example the system of fattening early weaned calves for sale as finished beef. The example refers to a 30-acre grassland farm in Hertfordshire; calves were bought each autumn at 10–14 days old and were finished out of yards at 18 months old at an average weight of 9 cwt, 35 animals being sold annually. The farmer wondered whether a more extensive system, finishing the beasts at 27 months, would be a better proposition. With older stock on grass, the size of the enterprise would have to be reduced to 12 calves annually, of which 11 would be sold fat at $9\frac{3}{4}$ cwt each year. The profitability of the two alternatives summarized is:

	Fat at 18 months	*Fat at 27 months*
	£	£
Total gross margin	677	271
Gross margin per head	19·3	24·3
Gross margin per acre	22·5	9·0

The gross margin per head obtained by selling the beasts at 27 months old is £24·3, compared with £19·3, per head from the younger cattle. However, 24 fewer beasts are now sold each year. Thus it is apparent that, although keeping the cattle on the farm for an extra nine months raises the gross margin per head, it slows down the turnover and reduces the farmer's gross margin by over £400 a year. This illustrates the fallacy of assuming that a high gross margin per head is the best test of success. What is important is the total return and the acreage and time incurred in its achievement.

Fat lamb

Just as with beef, so in sheep production is gross margin per acre a better measure of profitability. The next table illustrates the results for three typical systems of fat lamb production:

System of Fat Lamb Production	*Gross Margin per 100 ewes (excluding forage costs)*	*Acres per 100 ewes*	*Gross Margin per acre*
	£		£
Early	68	33	17·9
Late light	834	45	16·0
Late heavy	857	57	12·5

(Source: Farm Planning Data 1962, Farm Economics Branch, University of Cambridge.)

The same moral can be drawn; land use *must* be taken into account. In terms of gross margin per 100 ewes, late heavy fat lamb production is the most profitable—but it is the least profitable system when the gross margin per 100 ewes is related to the acreage and variable costs of the forage crops utilized by the flock. Despite having the lowest gross margin per 100 ewes, early fat lamb production has the highest gross margin per acre. This illustrates once again how misleading margin per head can be for choosing between alternative systems of fat lamb production. The most profitable system per 100 ewes would, in fact, yield the lowest gross margin from a given acreage of land.

Comparison with other enterprises

Expressing the profitability of land-using livestock in terms of gross margin per acre enables a direct comparison to be made with other enterprises.

Typical Gross Margins for the Major Cropping and Livestock Enterprises

Enterprise	*Gross Margin per acre* (£)
Wheat	30
Barley	25
Sugar beet and potatoes	60–70
Dairying	30
Beef	15
Sheep	15

This suggests that whilst dairying, beef and sheep production cannot compete with sugar beet and potatoes in terms of profitability, dairying is, on average, at least as profitable as cereal growing. Beef and sheep are usually less profitable than the cropping enterprises, but there are certain systems of production (e.g., fattening of early weaned calves for sale at 18 months old) which can compete with wheat and barley.

There are, of course, exceptions to this general picture, caused especially by differing levels of management, the size of farm businesses and the particular combination of enterprises. The other fixed costs besides land have an important part to play; for instance, dairy cows require more fixed costs than cereals on large acreages so do not compete there, but on smaller farms the reverse is often true. Also, beef and sheep production, although having a low gross margin per acre, do have a place in many farming systems where they add significantly to net farm incomes.

Brian H. Davey, B.Sc. (Agric.), is an Assistant Agricultural Economist in the Ministry's Agricultural Economics Division. He was previously an Assistant District Officer in the National Agricultural Advisory Service for 18 months and was stationed in Wiltshire.

Extension to Seale-Hayne

FURTHER generosity by the Trustees of the Frank Parkinson Agricultural Trust will enable a sizeable extension to be made to the Frank Parkinson Building, which has formed part of Seale-Hayne College since 1958. This building, designed to house forty-eight men students, has proved so valuable to the College that another forty-eight study bedrooms are now to be added. The extension, which should be complete by October, 1965, will cost about £70,000.

Expressing his warm gratitude to the Trust, Professor Ian Moore, Principal of the College, said: 'The ultimate goal of the Governing Body is to achieve residence for the whole College, and this additional gift of the Trust brings this goal much nearer. Moreover, for the Trust to express their faith in the work of the College in this tangible form is additional inspiration to staff and students alike, and will indelibly inscribe Jubilee Year in the history of the College.'

Weeds around the Farmstead

Stanley Evans

BEYOND the farmstead the fields may be clear of weeds, but what of the farmstead itself? Too often one sees a fringe of grasses, nettles, docks, etc., around buildings, alongside paths and perhaps elder bushes and brambles which have found a haven in odd corners. Why have them as a source of spread? Their elimination by chemicals is not a difficult job nowadays.

On foliage

Selective growth-regulator herbicides such as MCPA, 2,4-D, and mecoprop, normally used on cereals, and 2,4,5-T, developed for the control of scrub, are useful for killing broad-leaved perennial weeds because they are translocated from the foliage down into the roots. They may be used where broad-leaved weeds are to be controlled without harming the grass, but unfortunately some established weeds, such as docks and nettles, do not succumb too readily.

Docks are best treated with 2,4-D-ester, sprayed on at 1 lb in 20 gallons of water so as to give the plant a good wetting. The ester of 2,4-D can be volatile, and under certain warm conditions vapour may drift on to susceptible crops such as flowers and tomatoes. If this is to be avoided, 2,4-D-amine or 2,4-D-acid should be used instead. 2,4-D-acid is available only as a product specially prepared for the treatment of road verges.

Nettles are best treated with mecoprop at a concentration of about 2 lb in 20 gallons of water. 2,4,5-T can also be useful used in the same way. None of these treatments will seriously affect the grass. Sodium chlorate is also effective on nettles at 8 lb in 20 gallons of water, applied so as to wet the foliage well. This treatment will scorch the grass, but normally it soon recovers.

Dalapon, which is also translocated, is effective principally against grasses, whilst amino-triazole can kill both grasses and a number of broad-leaved weeds. None of these weedkillers generally persists in the soil; regeneration from surviving shoots or seeds may occur soon after application.

On soil

Sodium chlorate is more often used at higher doses than that suggested for controlling nettles to kill off everything. It acts also for a short time as a residual herbicide in the soil, preventing further weed growth. It has long been used in this way, but it has the disadvantage of making dead vegetation more inflammable, although some commercial products contain a fire suppressant. Today there are many other chemicals that may be used to maintain vegetation-free conditions and which have a more persistent effect than sodium chlorate. These include simazine, atrazine, monuron, diuron and borax. Since these act through the soil, their use on dense vegetation may be inefficient, and often they are mixed with a weedkiller either of the translocating type or a contact weedkiller, so as to allow the residual weedkiller a better chance to reach the soil.

Often it may be better to first remove the vegetation either by cutting, burning, cultivation, or by using a contact or translocating weedkiller separately. Paraquat can be particularly effective in killing foliage of mixed stands of grass and weeds. The advantage of split applications of the two types of weedkillers is that each can be used the most efficiently.

Timing

The best time for applying a growth-regulator herbicide such as 2,4-D and mecoprop against broad-leaved weeds, dalapon against grasses, and amino-triazole against broad-leaved weeds and grasses, is in the spring. Growth is then active and new foliage presents itself to the spray. Or spraying can be done in the autumn, before the weeds die down.

One of the best times for applying residual weedkillers is during the winter when foliage-applied weedkillers are ineffective. Most of the residual weedkillers are rather insoluble in water, but to be effective they must spread down into the surface soil and to the root zone of perennial plants. Winter and spring rainfall will do this before growth normally starts in the spring. These weedkillers have no effect on weed seeds but they kill germinating weeds. The roots of deep-rooted perennial weeds may not be reached by the weedkiller and the foliage-applied translocating weedkiller may for this reason be a necessary adjunct to those applied to the soil.

Dose according to soil

The type of soil can greatly affect soil-applied weedkillers. The dose required on a heavy soil or one rich in organic matter may be much larger than that required to produce a similar effect on weeds on sandy soils. The persistency of weedkillers can also vary markedly according to the soil and weather. For example, adsorption of the chemical in the soil varies with soil type. Heavy rainfall will encourage leaching, and weedkillers are likely to leach out of lighter soils more readily than heavy ones. The biological activity of the soil, as influenced by moisture, temperature, and organic matter, will also affect the rate of breakdown of a chemical. These factors are not the same for all weedkillers. Some are more readily attacked by bacteria than others, some are more readily leached than others, and so on. A range of doses of weedkillers, allowing for these variables, is given on page 320.

This sort of thing can easily be avoided by the use of suitable weedkillers

Chemical and weed

To help overcome some of the limitations imposed by soil type and rainfall and by different responses of weeds to the different soil-applied chemicals, commercial mixtures of two herbicides are available—for example, mixtures of sodium chlorate and monuron, sodium chlorate and borax, borax and monuron and borax and simazine. For general use around farmsteads in various situations, a mixture is usually preferable to a single weedkiller.

Most grasses and annual weeds are sensitive to monuron, diuron, simazine and atrazine once they have reached the root zone. Some perennial broad-leaved weeds will be better controlled in the first instance by a foliage-applied weedkiller, and subsequently soil weedkillers may be used to prevent reinfestation. Docks and nettles have already been mentioned. Ground elder, field bindweed, horsetail, plantains, silverweed, cinquefoil, ragwort and coltsfoot, and to some extent creeping thistle, are all difficult to control with soil-applied weedkillers. Some, like ground elder, horsetail and coltsfoot, are difficult to control by any chemical. 2,4,5-T has had as much success as any weedkiller on ground elder. Amino-triazole at twice the dose normally used for controlling couch, for which purpose it has been principally developed, applied in the autumn has also given good results.

Coltsfoot is best treated with sodium chlorate. Repeated applications may be necessary for eradication of both these weeds. Horsetail is hardly affected by any weedkiller, but continual treatment with MCPA may do something to reduce it. The shoots are readily killed but the roots are very persistent.

Plantains and ragwort succumb to MCPA or 2,4-D, but they can regenerate readily from seed, and soil-persistent weedkillers are not always very satisfactory in suppressing them. Silverweed and cinquefoil are resistant to the growth-regulator type weedkillers but can be fairly readily controlled with sodium chlorate or borate compounds.

MCPA will reduce creeping thistle infestations, but repeated spraying may be necessary. The success of MCPA and similar weedkillers in controlling broad-leaved weeds in grassland is partly due to the competition from the grass sward, which suppresses or smothers weakened shoots. Where all vegetation has been destroyed, this factor is removed and the control of weeds can be more difficult because of it.

Elder bushes and brambles can be killed by spraying them in the summer with the equivalent of 2 lb per acre of 2,4,5-T. The foliage and shoots must be wetted completely with the spray, and a large volume of water should be used. If elders have been cut down the stumps can be treated with a solution of 1½ lb of 2,4,5-T in 10 gallons of oil. The whole of the bark and the periphery of the cut surface—and any regrowth shoots—should be thoroughly treated. Stumps should not be treated when wet with rain.

Soil-applied weedkillers

The initial dose of soil-applied weedkillers needs to be the highest. Subsequent 'maintenance' treatments can be at lower rates, and as time goes on the annual treatment can become very cheap, provided the soil is not disturbed, because the store of viable weed seed in the soil surface becomes progressively depleted. On the other hand, resistant weeds can become dominant after a time, and it is important that the right chemicals are chosen for the job.

Doses of active ingredient of soil-applied chemicals
(per 100 sq. yards)

	Initial treatment	Maintenance treatment
Atrazine	3–7 oz	1–1½ oz
Borates (B_2O_3)	—	24–60 lb
Diuron	5–10 oz	2–4 oz
Monuron	5–10 oz	2–4 oz
Simazine	3–7 oz	1–1½ oz
Sodium chlorate	5–15 lb	—

Borates and sodium chlorate are the least persistent of these chemicals in the soil.

Initial treatment can cost anything from 8*s*. to 35*s*. per 100 sq. yds. The cost for small areas around farm buildings is not likely to be great; nor will applying the chemicals take up too much time. Generous use of chemicals is possible to ensure satisfactory results, but should there be any doubt on any technical point then advice should be sought.

Care in use

There are no toxic hazards in using these materials provided the manufacturer's instructions are followed, although stock should not be allowed to graze treated areas. It should be borne in mind that roots of desirable trees and shrubs may extend into the treated area and so pick up the chemical.

Erosion of treated surfaces can lead to persistent weedkillers being carried to garden beds and lawns. Sodium chlorate can wash through soils and drain into untreated areas. To avoid such damage, the drainage of the site should be considered. A rather insoluble weedkiller such as simazine does not move readily through the soil and, apart from mechanical transfer by erosion, presents little hazard to adjacent crops. Simazine is successfully and widely used in maintaining gravel drives and paths through gardens free of weeds.

The chemicals are normally applied as a spray; any slight drift of soil-applied weedkillers is not likely to be important. The drift of growth-regulator type herbicides, however, can be very damaging to sensitive crops, drifting on to flower-beds, vegetable gardens and into greenhouses and potato chitting houses. Granular formulations are often more convenient to handle and apply.

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HARD CASH from COLD GLASS

A. R. Carter

JUST over one-fifth of the total area of glasshouses in England and Wales is without any form of heating. No doubt more of this would be heated if the money were available, but it is also true that some is used cold by preference. An efficient grower getting good yields of the right crops can be assured of a satisfactory level of profit from cold glasshouses.

To grow only the most profitable crops is attractive advice but alas only a counsel of perfection. In practice, the holding must be considered as a

whole. There is no point in growing a crop that doesn't fit into a satisfactory rotation. A grower who has concentrated on vegetable and salad production might be tempted to try flower growing, only to find that lack of cultural and marketing experience jeopardized the success of the venture from the start. A new crop might require a new outlet for marketing or create an unbalanced labour demand which could not be met economically.

Using glass for raising seedlings in winter and spring can be profitable if they are required for planting out on the holding or if there is a ready-made outlet available. Growing on spec. is foolhardy. Search for a market will be time-wasting and might well delay planting the following crop. Obviously there should be no changes without an overall review.

Winter crops

The most widely grown winter crop is lettuce. On most nurseries where there is no demand for seedling vegetables, lettuce is unlikely to be replaced —provided it is grown well. Comparatively little labour is needed. It is cleared in time to plant a wide range of summer crops and the profit obtained can be equal to that from a 30 ton to the acre tomato crop.

Suitable varieties include Amplus, Kloek, Kwiek and May Princess. Planting towards the end of November or early December allows the seedlings to become established before winter. A good stand is ensured by treating the soil before planting with a dust containing pentazene or dichloran to control botrytis disease; if spraying can be carried out, a cheaper method is to use a mixture of thiram and zineb, which will also take care of downy mildew.

There is no point in allowing more than 8 inches square per plant. This density gives over 2,000 more per tenth of an acre than does 9 inches square. Saving another inch to give an 8 by 7 inch plant allows 3,400 more plants than at 9 by 9.

It is important that the soil should be flooded before planting preparations, and watering-in can be useful if the top 2–3 inches have dried out by planting time. Additional water is usually required in March, and overhead irrigation with misting nozzles is quite satisfactory, provided ventilation is given afterwards. Hard frosts in winter quickly dry out soils, but watering plus adequate disease control lead to a high stand. A full crop is profitable; half a crop could mean a loss.

Overwintered brassicas such as pot cauliflowers valued at £7 or £7 10*s*. a thousand for planting out in early spring give a profit at least as good as that from lettuce. Peg plants pulled from the floor of the house valued at one-third of the price are not as good, but still give a useful profit. Early Brussels sprouts plants at 30*s*. per thousand are reasonably comparable with peg cauliflower plants, and raising Primo type cabbage can also be rewarding. Propagation of early brassicas such as cauliflower allows the next crop to be planted earlier than if lettuce had been grown, and this might be a useful way to obtain better or earlier second crops and to spread the labour demand.

Although not widely grown, mint is worth considering if the market prospects are good. It usually occupies the house from November or December through May, and can be followed by a June planting of October-flowering chrysanthemums. One bushel of roots is sufficient for about 3 sq. yards, and picking usually starts in February. A top dressing of a nitrogenous fertilizer in February and frequent waterings are required.

Unheated Dutch light houses at Luddington E.H.S.

Summer crops

Without doubt, tomatoes are the basis of most rotations, and a more profitable crop than 40 or more tons to the acre is unlikely to be found. If this target is not being achieved, consider methods of improving yields before trying alternatives. Root problems might be solved by sterilization or by grafting on to resistant rootstocks, but it must be borne in mind that cultural methods often have to be modified when more vigorous growth follows.

The introduction of a shorter-term summer crop such as early flowering chrysanthemums, which can be cleared in August to allow chemical sterilization in the early autumn, is worth thinking about. The profit will only equal that of a 20–25 ton to the acre tomato crop but, because of higher temperatures in autumn, the chemical fumes will be cleared in time for lettuce planting and the yield from a following tomato crop should be increased. At Luddington Experimental Horticulture Station in 1962, a house treated with a soil drench of metham-sodium on 23rd August successfully carried a pot-grown crop of chrysanthemums brought in three weeks afterwards. Further work is needed before this treatment can be recommended, and it must be emphasized that the crop brought in was nearly mature and was not planted into the soil.

For early-flowering chrysanthemums to be a success, they must be really early flowering. The bulk must be cleared before the outdoor crop appears on the market. Varieties such as Sweethearts and sports, Golden Delightful and White Hope Valley should be planted 9 by 8 inches no later than the beginning of April. This makes overwintered cauliflowers an ideal preceding crop, as they are moved out before a lettuce crop is cleared. The chrysanthemums should be stopped two or three weeks after planting, so that an average of three stems per plant is produced.

Direct-drilled flower crops in rows 9 inches apart have been costed at Luddington, but in spite of a low labour requirement for growing, the results don't compete favourably with a good tomato crop. The picking and

bunching costs are disproportionally high compared with the value of the crop when sold on a wholesale market. Particularly is this so with Lilliput zinnias. Ten-week column stocks are worth a further trial, either to allow early chemical sterilization or to be followed by an autumn lettuce crop.

Autumn crops

In a standard rotation, including lettuce and tomatoes, pot-grown October-flowering chrysanthemums form the autumn crop. The profit from these is not great in some years, but the costs of production can be kept down by setting out the pots in beds four rows wide and by filling them *in situ*. This simplifies staking, as the pots do not blow over so readily when in a block and watering can be carried out by irrigation lines. Provided the ground is clean at the beginning of the season, weeds between the pots are not much of a problem. Any appearing there or on the paths can be controlled by carefully applied contact herbicides such as those containing cresylic acids, paraquat or diquat. Potting up should take place in May. Successful varieties at Luddington include Amy Shoesmith, Charles Rowe, Hugo, Marie Brunton, Maestro and Orange Stuart Ogg. Direct-planted chrysanthemums are cheaper to produce; they are also more difficult to fit into a rotation, but they can follow bedding plants.

The newer Dutch varieties of lettuce have made autumn production easier. Amplus sown in rows 9 inches apart on 16th August, 1962, were very successful, and the high quality heads (produced by thinning the seedlings to stand about 9 inches apart in the rows) attracted returns two or three times as high as outdoor-grown lettuce.

Caution on radical changes

Economic studies to date have confirmed the value of lettuce followed by tomatoes and autumn chrysanthemums. At present these crops are not likely to be replaced on a large scale by other rotations, and unless special conditions such as favourable outlets for other kinds of produce apply, growers should be cautious about making radical changes. On most holdings, lower production costs by good management and use of modern techniques, coupled with improvements in crop yields and quality, are more likely to bring in more hard cash from cold glasshouses than a search for more profitable crops. Nevertheless, economic studies are continuing over a wide range of crops, and future results or changes in market requirements could lead to a need for some modifications in the cropping programme.

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The story of a North Riding farmer who made an experimental excursion into barley-fed beef production and cleared £20 gross profit per beast

Trying out Barley Beef

M. B. Rutherford

It has been said that farmers believe nothing they hear and only half of what they see. But there must be exceptions. For example, Mr. T. Gudgeon, who is a tenant farmer of 160 acres of medium land known as Raincliffe Farm, Scalby, near Scarborough.

When he took the farm three years ago, Mr. Gudgeon's policy was to plough and crop much of the grassland, so corn growing is now the principal enterprise. He also keeps a small grassland flock of Half-bred ewes. Although farmyard manure has a place at Raincliffe, Mr. Gudegon is emphatic that any livestock enterprise must justify itself. The original idea was to feed beef cattle on roots, but labour difficulties defeated him, and they were replaced by silage in 1960. This venture was reasonably successful, but Mr. Gudgeon was not satisfied. He wanted a more profitable system of beef production. Why not barley beef? Here was an enterprise complementary to the corn-growing policy already adopted. Also it would ensure an adequate supply of farmyard manure.

At all times concentrates were fed ad lib. from two self-feeders

Friesian-type bull calves

For a pilot trial, 21 pure-bred Friesian-type bull calves were bought in June, 1961. Supplied by a reliable dealer, they were delivered straight from a West Riding farm. The average cost was £10 15*s.* 8*d.*—not at all unreasonable for week-old beef-type calves weighing 100 lb. On arrival, they were immediately injected with white scour anti-serum, and the first two feeds were of glucose and water. Gradually a proprietary brand of milk substitute was introduced and at about 35 days of age the calves were abruptly weaned on to a concentrate, home-mixed to a Rowett recommended formula.

Two calves died from scour; otherwise no other ailments were noticed.

By the end of October a new concrete barn and lean-to were completed, into which the 19 calves were moved. All the barley used was home-grown. Some of it indeed was fed only two weeks after being combined, but this had no adverse effect, though it is important to note that all the corn was fully ripe. Particular attention was given to the physical condition of the grain, and at 17 per cent moisture, rolling was no problem. The supplement was a proprietary brand sold in pelleted form and mixed with barley in the ratio of 1½ : 8½. At all times concentrates were fed *ad lib.* from two self-feeders, each costing £13 10*s.* The feeding face of 6 feet was adequate, providing an average of about 3½ inches per beast. At five months the animals were implanted with 60 milligrams of hexoestrol.

A useful feature of the Rowett system is the relatively small floor space required per beast. At Raincliffe 34 sq. feet was found to be adequate. The bullocks were often waiting to be bedded and, afterwards, seemed to relish eating the straw. Mr. Gudgeon firmly believes that, taken in small quantities, straw is a useful insurance against digestive disturbances. Consequently bedding the cattle became a daily operation.

Seventeen finished

Another two animals died in early May, due probably to urinary blockage. Seventeen animals were eventually finished and drawn over a period of about four weeks. Mr. Gudgeon had previously arranged a market and price with a local butcher. All the bullocks were sold dead weight at 3*s.* 0½*d.* per lb (equivalent to £9 4*s.* 4*d.* per live cwt).

The Raincliffe Figures

	Average
Return per beast	£70 13*s.* 6*d.*
Variable cost per beast*	£50 9*s.* 2*d.*
Gross margin per beast*	£20 4*s.* 4*d.*
Days—purchase to slaughter	340
Average weight at slaughter	860 lb liveweight
Liveweight gain per day	2·24 lb
Conversion ratio	4·5 : 1
Killing-out %	57
Return per lb dead weight	3*s.* 0½*d.*
Return per lb live weight	1*s.* 7¾*d.*
Variable cost per lb live weight	1*s.* 2*d.*
Gross margin per lb live weight	5¾*d.*

*Variable costs are those expenses directly attributable to the enterprise, i.e., they would not have been incurred if the enterprise had not been undertaken. The Raincliffe figures therefore include the variable costs of 21 animals, although 17 was the actual number finished. The net profit of the enterprise is calculated by deducting from the gross margin the labour cost and a share of the overhead farm expenses.

New barn and lean-to, housing nineteen calves

The figures discussed

The sum of £22 has been taken as the average saleable price of barley. Mr. Gudgeon does not normally keep all his grain until the maximum market price is reached; thus it is felt that £22 represents a reasonable charge. A gross margin of £20 per beast was left. Had all 21 animals survived, the margin per beast would have risen by at least £5. Even so, bearing in mind that no animal was more than one year old, this is no mean performance, especially compared with other systems of beef production.

Gross margin per sq. foot of floor space is a useful efficiency measure sometimes used in pig costings. At Raincliffe the group of bullocks left a gross margin of nearly 15*s*. per sq. foot of floor space. If such a performance can be consistently achieved, then for Mr. Gudgeon barley beef is a possible and equally profitable alternative to the production of bacon pigs.

The question arises 'How high must the price of barley be before the enterprise becomes uneconomical?' Using the data provided by Mr. Gudgeon, there would still have been a gross margin until the price of barley rose to about £38 per ton. Obviously, any rise in average price above £22 would have reduced his margin.

What then are the lessons to be learned from this small pilot trial? In the first place the introduction of a barley beef enterprise on this farm has enabled the farming system to be simplified, with consequent economies in labour without loss of profit. Second, it is evident that stockmanship is fundamental to success in barley beef production. Third, a keen regard for business principles is essential. As food represents about three-quarters of the cost of production, its use against liveweight gain must be checked carefully and continually.

Research Spot

CATTLE
SHEEP
PIGS

Some points made at this year's meeting of the British Society of Animal Production

Reported by ***F. J. Willis***

Cattle

Two items of current research from the Rowett Institute are of particular interest to cattle men. Dr. Preston and his colleagues have intensified their search for improved rations for the production of early beef. They are now satisfied that heat-treated fish meal is the best source of protein for inclusion in the early weaning rations of calves that receive no roughage. Such a ration should include at least 30 per cent oats plus flaked maize, molassine meal, minerals and vitamins. Crude protein in the dry matter content should be at least 19 per cent.

Results from a trial of bulls versus steers, fattened intensively on a high barley ration, have suggested that the forthcoming large-scale national trials may be of more than academic interest. Bulls at the Rowett made faster gains and converted more efficiently than their twins which were castrated at six weeks old; the steers killed out better and their meat was tastier, probably due to a higher deposition of fat. One wonders whether castration by implantation, if this is practicable, might achieve better results than either group. The Russians are known to be experimenting with partial castration by surgical means.

Sheep

The findings at Great House E.H.F., which suggested that the dry matter content of silage is critical for feeding ewe hoggs, have been confirmed at the Grassland Research Institute. It is also suggested that silage, unsupplemented by cereals, is unlikely to produce significant liveweight gains. Nor do hoggs appear to be psychologically suited to a self-feeding system; they have a strongly developed herd instinct which leads them to feed and rest as a flock. Farmers will know that this does not apply to suckling lambs, which take readily to self-fed silage.

A report from the Agricultural Research Council, on mating behaviour in hill flocks in Scotland and Wales, has stressed the importance of the ram in stimulating oestrus. In an effort to reduce lambing spread, some lowland farmers are already using vasectomized or teaser rams. But this stimulus is effective only where ewes have previously been segregated from the rams for some time—probably at least two months.

From King's College comes a report on ewe breeding records and lamb weights in two lowland fat lamb flocks, over a period of four years. Neither flock was self-supporting in respect of replacements, and results confirm American findings that repeatability of milking capacity and prolificacy in ewes is very low. These results underline the dubious value of individual ewe recording in a commercial flock which buys all its replacements.

Dr. Blaxter's report of his successful attempt to produce an 'artificial sheep' has been received with much interest. Scientists working on trials with animals out of doors, have long been handicapped by their inability to measure the stresses which are imposed by varying climatic environments. The 'sheep', manufactured at the Hannah, has proved itself capable of assessing heat losses from the animal body; food wastage in this manner can now be measured with reasonable accuracy.

Pigs

Work at Leeds and the A.R.C. Cambridge has emphasized the importance of environment to the suckling pig. The Leeds research results also demonstrate that the larger, livelier sucker can stimulate increased milk production by the sow; this probably explains why runt pigs seldom catch up with their more precocious litter mates, and birth weights can be a critical factor in survival. A report from Northern Ireland suggests that rapid rates of gain between weaning and 120 lb live weight may be detrimental to carcass quality.

The British Society of Animal Production draws its members largely from research workers in the field of animal husbandry and genetics, and from the ranks of the N.A.A.S. But membership is open to anyone interested in the improvement of farm livestock—either by breeding or management.

Stemmy, fibrous herbage means low intake per animal and therefore poorer returns. Obvious? Perhaps. But it's a point often overlooked

Digestible Pasture

Ronald Harkess

MANY farmers are finding that their swards are capable of producing bigger yields of herbage. For this we must thank the more productive species and strains and the greater awareness of the value of nitrogen fertilizers. It is obviously economic suicide if the expense incurred in producing this herbage is lost by poor utilization. Although the actual bulk of herbage dry matter will continue to increase after flowering, farmers know full well that their stock, particularly dairy cattle, do not do so well on stemmy herbage as on less mature herbage.

Digestibility = Pasture productivity

Once herbage is eaten and has passed into the rumen, it is broken down by bacteria into a state in which it can go into the lower digestive tract. Nutrients are absorbed into the blood stream, from both the rumen and lower tract, and are then utilized by the animal. The physical condition of

the feed regulates the activity of the rumen organisms, so that the digestibility of the herbage is of pre-eminent importance to animal output—and that means pasture productivity.

Up to the stage of ear emergence digestibility falls slowly. Thereafter it falls more quickly. We also know that different species of grasses and legumes have different digestibility coefficients, even at a similar growth stage: for example, the digestibility of the organic matter of S.37 cocksfoot falls from approximately 76 to 56 per cent from May to mid-June, whereas S.24 ryegrass drops from 83 to 60 per cent. S.100 white clover not only remains higher in digestibility over this period but keeps it longer in the season, falling from 88 to 79 per cent by mid-June.

Of the other herbage varieties widely used today, meadow fescue and timothy rank with ryegrass, while tall fescue and lucerne are of lower digestibility. It is interesting to note that herbage regrowths are not so digestible as first-cut herbages, although they may come close to it.

Experiments which I made with dairy cattle and sheep have shown that both will digest a similar feed to the same extent. But using animals is expensive and time-consuming. A laboratory 'test tube' digestibility method, in which a herbage sample is digested by stomach juices extracted from sheep, can be carried out just as effectively and more quickly. For example, a sample of fresh herbage fed to sheep and cattle had digestibilities of 81·4 and 81·7 per cent respectively. The 'test tube' value was 79·1 per cent.

This new method is being developed as a further aid to predicting the feeding value of herbage. At present, crude protein and crude fibre are used as evaluation indices of herbage, but current research is showing that careful interpretation is necessary before relating these directly to nutritive value.

Digestibility and feed intake

As was said earlier, feed intake can be thought of as a mechanical process. When the rumen is emptied, the animal feels hungry and seeks more food. Mature herbage takes longer to go through the gut so the animal's intake falls. The importance of this came out at North Wyke Experimental Station recently, when two barn-dried hays were compared. One had an organic matter digestibility of 55·7 per cent, the other 75·2 per cent. The latter was 35 per cent more digestible than the former. Dairy cows ate 62 per cent more of the higher digestible hay, and this naturally led to a higher milk production.

The lesson, then, is that as digestibility falls, feed intake falls. After ear emergence, when the digestibility of herbage is falling by half a unit per day, intake falls by about twice as much. This in turn leads to a 7–10 per cent reduction in intake for each week cutting is delayed after flowering.

Palatability also plays a part. In an investigation at Nottingham, S.215 meadow fescue, S.48 timothy, S.100 white clover and S.23 ryegrass proved to be the most readily eaten. Cocksfoot was not so popular. Is it only mere coincidence that the more palatable species are also those with a higher digestibility?

Five points

From these digestibility studies several practical points emerge. First, the stage of growth at the time of utilization is very important in determining

the quantity of nutrients available to the animal. To maintain a constant supply of highly nutritious forage, catch the grasses before they flower. High milk yields can be obtained from young grass as the sole diet. Silage and hay, which are cut at a later growth stage, usually need some supplementation if high yields (maintenance plus 4 or 5 gallons) are to be obtained. Both silage and barn-dried hay should produce more milk than field-cured hay, since they are cut and carted earlier in the season.

Second, grass species have different digestibility coefficients. Cocksfoot is usually poorer than ryegrass at the same stage of growth. This means a lower intake of less digestible feed and so milk yield falls. Timothy hay can be valuable because it is late flowering and cut when less mature than, for example, S.24 ryegrass, which flowers in mid-May. Because different species of grass vary in their date of flowering, the use of several different sward types will extend the period of high digestibility.

Third, the high digestibility of white clover is of particular interest, since it keeps this high value when that of grasses is falling off. It will tend to enhance the overall nutritive worth of a mixed grass/clover diet at this time. High lamb liveweight gains have been recorded from pure clover swards. The flush of highly digestible clover comes when lambs are capable of quick growth and offsets the declining nutritive and palatability value of grasses.

Fourth, late regrowth crops are not as digestible as earlier cuts. This partially explains why aftermaths which look good in September do not appear to yield the same quantity of milk as do swards of similar appearance in spring. Autumn grass or foggage can be of useful feeding value, and where fields are laid up for this purpose they should be grazed bare or topped in late August. This will ensure a feed of new and young herbage not contaminated by old grass stubble or flowering heads.

Finally, the use of fertilizer greatly enhances the herbage production from a sward. It is the timely harvesting of this herbage as a digestible feed rather than a bulk yield that is a key factor in the efficient and economic output of animal products from grass and conserved fodder.

Ronald D. Harkess, B.Sc., M.S., Ph.D., N.D.A., formerly Fisons Research Fellow, University of Nottingham, has been with the West of Scotland Agricultural College since March, 1962.

Michael King

CARNATIONS as an Annual Crop

M. A. King and A. D. Harrison

CARNATIONS are being planted more and more closely. Ten years ago a spacing of 8 in. × 8 in. was usual, and more recently 6 in. × 6 in. Now we are thinking of 3 in. × 4 in. plantings.

The crop on which these notes are based was grown in a comparatively new house 100 ft × 29 ft (approx. $\frac{1}{15}$ acre). The glass was thoroughly cleaned before the crop was put in. The beds were treated with metham-sodium, and each received six barrow-loads of grit and 4 cwt peat. Fertilizers were also applied to bring the compost up to the level of JIP $1\frac{1}{2}$.

Rooted cuttings produced in South Africa were bought at £25 per 1,000. They were exceptionally sturdy, short jointed and generally well furnished with roots. Some were infected with rust, *Uromyces Dianthi*, and this disease persisted throughout the life of the crop in spite of fungicidal treatment.

Planting was on 18th December, 1961, in five beds each 3 ft 6 in. wide—equal to approx. 1,500 sq. ft—allowing for pathways between and at the end of the beds. The plants were spaced at 3 in. × 4 in., giving a total of 18,000 in the house.

Management

Plants grown under this system are not stopped. The vigour of the rooted cutting is held to be sufficient to enable it to develop a marketable flower on the original growth. While the majority did so, about 90 per cent carried the bloom on a stem too short to produce a first-grade flower.

'Pink Sim' – cut firm. A good specimen.

Watering and liquid feeding was through the 'Alma' irrigating harness. In this system a $\frac{3}{4}$ in. light plastic hose is laid on the sides of the bed, and jets spaced at 2 ft 4 in. intervals discharge water in a semi-circular pattern into the beds at ground level. The system is satisfactory on carnations at normal planting distances, but with a close-planted crop interference by the plants stopped sufficient water reaching the centre of the bed. A supplementary hose in the centre of the bed corrected this trouble.

Proprietary liquid feeds with a 1 : 1 ratio of N and K were applied constantly from the time the plants were established. Some additional N was given on a few occasions.

The plants were supported in the usual way, with wires running lengthwise and cross-strings. The important feature was that this short-lived crop was adequately supported throughout its life by only five layers of netting, and this meant a considerable saving—especially in labour. Disbudding was also carried out for the most part at a very convenient height, which also reduced the cost of the operation.

Diseases and pests

The rust which came in with the cuttings has already received mention. *Fusarium culmorum* caused some damage at ground level and also some dying back of the stubs left after cutting. It was felt that a close-planted crop would most probably suffer more from diseases than a crop set at normal distances, partly because the mass of foliage in a limited space would produce a favourable environment and partly because of the problem of obtaining adequate cover. Zineb was used as a routine measure of control, but while it may well have limited the spread it did not eliminate either of the diseases mentioned. Routine treatment for the control of pests proved effective and no serious trouble was experienced with either aphid or spider.

Month-by-month marketing

The first flowers were picked on 13th April, and the following table gives the accumulated total sent to market month by month.

Monthly totals of blooms harvested

		Average price per dozen	Value
		s. *d.*	£ *s.* *d.*
April	481	6 3	12 10 6
May	12,913	3 1½	174 17 3
June	4,285	8 4½	149 4 7
July	18,104	2 2½	160 5 11
August	24,105	2 7½	263 13 0
September	6,521	3 6	95 2 0
October	3,052	5 0	73 12 0
November	946	7 0	27 11 10
TOTAL	70,407		£956 17 1

An examination of weekly figures shows that 39,000 blooms were picked and marketed between 12th July and 30th August—approx. 56 per cent of the crop.

This heavy summer flush is in line with what occurs in all carnation crops but may be accentuated with closer planting. On a larger scale it would make a heavy demand on the packers and packing-shed resources.

The total of 70,407 blooms per 18,000 plants is just under four blooms per plant. It was estimated that five blooms per plant might be obtained, but losses from *Fusarium* were considerable, so that while many plants must have carried five flowers, these losses reduced the average yield.

The last flowers were cut on 16th November. Before the plants were removed all buds of reasonable size were taken and brought a worthwhile return when sent to market.

Financial attraction

The crop of approximately 46 blooms per sq. ft within eleven months of planting compares favourably with the crop expected from more normal spacing. The cost of growing the crop, apart from buying the cuttings, would be much the same as is incurred in the first year of a two-year crop but

One of Michael King's houses, containing a close-planted crop of carnations. In this instance the spacing was 4in. × 4in.

again, apart from the cost of cuttings, would show a very considerable reduction when compared with the costs incurred in the second year of a two-year crop.

The advantages of the system might be stated briefly as: increased gross takings per year; reduced costs of routine work, mainly because of shorter crop; crop could be grown in a house not high enough for a two-year crop; and the opportunity of steam sterilizing annually to prevent build-up of *Verticillium Wilt*.

The disadvantages are the high cost of rooted cuttings—three times as much as for normal planting distances; doubtful quality of first flowers; heavy and concentrated flush in July and August; and the incidence and control of foliage diseases.

Although this article is based on a crop planted in mid-December, it would seem from spacing experiments carried out at the Glasshouse Crops Research Institute that a heavier and probably more profitable close-planted crop might be harvested from a crop planted at the end of June.

The authors: **Michael A. King** took over a 12-acre holding at West Chiltington, in Sussex, in 1955 and now has one acre under carnations; **A. D. Harrison, N.D.H.,** has been Regional Adviser on Glasshouse Crops and Flowers in the South-eastern region of the National Agricultural Advisory Service since 1949.

A note on a four-weeks course for nine men held at Folkestone last winter under the auspices of the Court of the Worshipful Company of Farmers

An Advanced Course in Farm Business Management

James Garson

THERE has been a feeling among some members of the Court of the Worshipful Company of Farmers that they should try to do something about bridging the gap that exists between a farmer's ability to farm his land well and his ability to run his business efficiently. With generous help from elsewhere, a four-weeks course was arranged at comparatively short notice, in which nine of us participated. Wye College was asked to run the course

and to produce the majority of the lectures, and I am sure they could not have chosen better. The time and trouble taken by the organizers, and particularly Ian Reid of the Department of Agricultural Economics at Wye, must have been tremendous.

Any lingering feelings of guilt at deserting our farms that we may still have had on that first morning in January were swept away as we were plunged into what proved to be the most fruitful four weeks that I have spent since I left the University, and I am sure all the others will agree.

We had been selected on our records in farm management, and I think it is fair to say that we all had some measure of confidence in how we were doing our individual jobs. But on the very second day we were asked to assess and criticize the business of a most helpful local farmer. This brought us right down to earth; we were subjected to continuous probing on lectures which went on throughout the four weeks. Why should we do this? How would this affect such and such? It was revealed how far we had to go in achieving an orderly method of approaching a farm problem. This method of approach to any problem, and indeed establishing what the problem was, provided the meat for a large part of our course.

A well-balanced programme

The planning of the course had been thought out most carefully, and a well-balanced programme was the result. The lectures were so arranged that the programme moved smoothly from the establishment of what the problems were through to their solution. As the problems put before us became more complicated, so the planning technique became more sophisticated. Finally what had for most of us been the mysteries of linear programming were admirably explained to us by John Nix, also of Wye College. Several outside lecturers were invited to speak to us as well as those from Wye: Alan Harrison from Reading, during a series of lectures on capital, explained to us how to assess the return on new equipment and if or when it was advisable to replace equipment. The provision of credit for farming was discussed by A. R. Collingwood and F. W. Jennings. Some of the most interesting periods were spent on the interpretations of balance sheets and also the effects of taxation on farm policy. As a relaxation from the continuous bombardment on financial matters, four periods were set aside for lectures by experts on such subjects as continuous barley growing and research on development in clover seed production.

Interspersed with the lectures were farm exercises based on real farm problems, supplied either by ourselves or by very co-operative farmers who revealed the innermost secrets of their accounts in order to make the exercise really useful. The fact that there were only nine of us on the course allowed us to get to know each other well enough to lose any self-consciousness in revealing our lack of knowledge. Also this small number allowed each person to have his queries satisfied even if this meant, as often happened, the discussion continuing throughout the break that followed it.

Financial realities

We were constantly reminded that economics is not a panacea for all our problems, but at the same time we came to realize more fully that it is not confined merely to the theoretical or idealistic approach. This period of concentration on the financial side of the business revealed the tremendous

potential that exists for study and indeed the vital necessity that every man who calls himself a farmer should try to learn as much as he can of this side of the business. He must come to understand it in the same way as he does the technical details of crop or livestock production.

The N.A.A.S. does a marvellous job in getting the farmer to realize what are his most urgent problems at any time, but I am sure they would readily agree that their effect on a subject as complicated as that covered by this course can only be slight. Even a one-day conference can merely whet the appetite of the intelligent farmer. The opportunity for any form of study in practical farming problems at the post-graduate level is almost non-existent, and I am certain that the Worshipful Company of Farmers has achieved a tremendous step forward in promoting this course.

The success of the planning was quite clear when, on the last day, we were encouraged to evaluate the course. Criticisms were few. The main thought running through the evaluation was the tremendous boost which this course had given us. We hoped that every effort would be made to repeat it every year and, although it was asking rather a lot, we wondered whether there might be even some shorter course about five years later for those who had been through this first course.

Looking back on the course, I think each one of us in varying degrees would admit that his approach to so many of his problems, and indeed possibly to farming as a whole, has been altered. We are now in a much better position to pose the true problem, to avoid the red herrings and yet to see the fringe effects. We can now face our financial advisers on a slightly more level footing and can, in point of fact, advise them how best they can show our accounts so that we may be able to use them to frame our future policy. We have learned the value and necessity of forward budgeting, not just every now and then but each year as a routine. We have learned some of the pitfalls that can occur when doing this very budgeting; and in one short period we learned when it may be wise to say nothing rather than to speak too soon!

In essence, we have been shown the way to approach one part of our business, and it is up to us to put to good use all the time, effort and money that has been spent on us. I know that all who were at Folkestone this year will hope that some way may be found to allow others to enjoy the opportunity which we have had.

James Garson is Manager to S. V. Christie-Miller (Farms), Ltd., at Clarendon Park, Salisbury. He also acts as a consultant on other farms in the area.

M. T. Armstrong

R. W. Howe

Saw-toothed Grain Beetles

TWENTY-FIVE years ago the most destructive insect in grain stored on farms and by agricultural merchants was the granary weevil. During the last ten years most of the trouble has been caused by the saw-toothed grain beetle. This beetle requires warm conditions (grain temperatures over 65°F) for is growth and development, so the temperature of home-grown grain stored in farm bins and in larger bulks held by merchants is of special importance.

Beetles thrive in warm conditions

The first loads of combined grain come into the store in early August when the air temperature in some barns reaches 85°F—even higher if a grain drier is being run. Everyone acknowledges that at harvest time, when the weather is right, there is too much to do. The drier is being operated at full capacity and the grain may be rushed through the cooling section without being properly cooled and often without adequate cleaning. Normally it goes into bins, sacks or on to floors at temperatures around 75–80°F; but it may be as hot as 100°F. In these circumstances there is the risk that some grain may be thought to be dry enough for safe storage and may be mixed with grain already dried. Unfortunately grain which, though damp, would store well at 50–60°F, will not do so at 70–80°F, so 'damp grain' heating up to 125°F often follows. Here, then, are the warm conditions which saw-toothed grain beetles need for successful breeding and feeding.

Before they can become established, however, the beetles still have two hazards to overcome. The first of these is that they are not able to feed on undamaged grain unless it is damp and soft; in general, they depend upon

dust, broken kernels, branny particles and damaged, sprouting or mouldy grains. Adequate cleaning of grain before storage may, therefore, prevent or reduce their ravages. The second hazard is the slow rate at which grain cools. The average air temperature in August and after is usually below 65°F, so that the grain stored at 80°F ought to cool. If it is kept in bins holding not more than 50 tons, it will probably cool to 65°F in three months provided it is not damp and contains no insects. If the bins are so placed that they form blocks, the grain in them will cool more slowly, and if placed in bulks of 500–1,000 tons on concrete floors between bulkheads at depths of 10–16 feet, it will probably not cool at all in the centre. In the latter form of storage, damp patches and a relatively few insects will eventually cause heating. In small bins, greater numbers of insects may fail to induce heating unless assisted by moulds growing on damp grain.

Dealing with an infestation

If infestation by these beetles is known to be present in a granary, the premises should be cleaned thoroughly as soon as the old harvest has been removed. Special attention must be paid to the dark corners and crevices, for it is here that the beetles are likely to collect. When the surfaces are clean, the bins, and the granary walls, floor and beams should be sprayed with a water-dispersible malathion preparation, and malathion dust should be properly mixed with the grain as it is loaded.

The freshly harvested grain should be cleaned before drying. After drying, besides the routine checking of moisture content, the temperature of the grain should be taken by thermometer, either on the conveyor belt or as it enters the bin. If the grain is warm and it is not feasible to cool it more efficiently in the drier, it should be loaded in a way in which it will cool most rapidly—into small bins or shallow layers. Should it remain warm, it must be turned again later, unless insects are thought to be present. If too damp it should be re-dried as soon as possible after the main rush of harvesting.

These measures should in turn reduce the numbers of insects in the granary, remove the most easily available food, make the living conditions less favourable and kill some of the insects invading the grain.

Should an insect population still build up, fumigation can be attempted in bins which are gastight, or can be made so by covering with sheets, and the remaining fabric of the premises should be sprayed once more.

When good design helps

In old farm premises it is often difficult to carry out a reasonable programme against pests, but new buildings should be designed better. Insecticides will not give good results if sprayed on to or covered by dust. Machinery and buildings should be designed and arranged so as to make cleaning easy. The drier ought not to be in the same building as the storage bins; if it is, it should discharge its heat *outside* the building and should use the driest air possible for the drying. Granary roofs, especially if they are of metal or contain roof-lights, should not be too close to the bins, because with this kind of roof the air temperature close to it will be high at harvest time. The bins should not be too large, and if in blocks they should have as many outside walls as possible to facilitate cooling. But the outer walls should preferably not be exposed to the weather because very cold

walls, especially with metal bins, can cause caking. Ventilated bins are useful; the ventilation can be used for cooling. And a system of cooling channels built on to floors used for bulk storage would be highly desirable for grain loaded during August and early September.

The saw-toothed grain beetle problem arises through the unhindered build up of populations over a number of years and it is due entirely to the storage of warm grain which, because it is too warm, is also too damp.

Mrs. M. T. Armstrong, B.Sc., D.I.C., M.I.Biol., is a Senior Scientific Officer on the staff of the Ministry's Infestation Control Laboratory and is Entomologist for the Northern Areas, based on Liverpool. She has had 20 years' experience in the stored products field and, since becoming Area Entomologist, has had a special interest in flour mill infestations and the control of warehouse pests.

R. W. Howe, D.Sc., M.I.Biol., is a Principal Scientific Officer at the A.R.C. Pest Infestation Laboratory at Slough. A Commonwealth Fund Fellow, he was a member of the Imperial College team which made the original survey of pests of grain in Britain in 1938–39. He studied storage problems in Nigeria and the U.S.A. and carried out research on the biology of many storage beetle pests, with special reference to grain heating.

The Ministry's Publications

Since the list published in the June, 1963, issue of *Agriculture* (p. 290) the following publications have been issued:

LEAFLETS

FARM MACHINERY LEAFLETS

No. 20. Farm Grinding (Revised) 6*d.* (by post 9*d.*)

FREE ISSUES

Farm Incomes, Costs and Management

A guide to the reports published by the Provincial Agricultural Economic Service 1962–63.

The Safe Use of Poisonous Chemicals on the Farm. APS 1 (Revised)

OTHER PUBLICATIONS

Report on safety, Health, Welfare and Wages in Agriculture, 1st October 1961, to 30th September 1962 (New) 2*s.* (by post 2*s.* 4*d.*)

These publications are obtainable from the Ministry (Publications), Government Buildings, Block C, Tolcarne Drive, Pinner, Middlesex.

THE AUTHOR

This account of the trend of thinking in American agricultural colleges will be of no small interest to our own teaching staffs and students

Teaching Animal Husbandry in the U.S.A.

T. G. Boaz

THE meaning of the term Animal Husbandry as a subject of university study varies from State to State in the U.S.A. Generally, it is restricted to beef cattle, pigs and sheep, and their common product—meat. Growing emphasis on the product, as distinct from its production, and its significance to discerning consumers, has led in some colleges to a marked expansion in meat research and teaching facilities. Considerable emphasis is in fact placed on carcass evaluation, quality and utilization. At some colleges meat science (*sic*) is no longer dealt with by the animal husbandry department, but by a separate department dealing with food.

Dairy Husbandry is usually the concern of a separate department, in some cases established by State law, particularly where milk production is a major feature. Dairy products may be included here, or may form a separate department or be in a department of food science. Similarly, there will usually be a department of poultry husbandry, with specialist staff and research facilities.

Research and advisory work as well

To English eyes, this proliferation of departments and the differences in organization at different universities is a little bewildering. It must be remembered though that each college of agriculture, and each component

department, is responsible not only for teaching (encompassing farm institute, college and university levels of instruction found in England and Wales), but also for research and advisory work. There is considerable merit in grouping specialists in any one branch of agriculture under one administrative head. Close contact between teachers, research workers and advisory specialists ensures the flow of ideas and knowledge to and from the farm and public. This is particularly true where the lecturer in a specific subject is also the advisory officer for the State.

Individual members of staff are responsible for beef cattle production, pig production, etc., and each will give courses or carry out research in well-defined areas. In the larger departments of animal husbandry there will also be lecturers in the more fundamental subjects such as breeding, nutrition and physiology; in extreme cases on a species basis also. This concept may be carried right through to the provision of facilities for demonstration and research.

Most of the departments of animal husbandry which I visited had separate beef cattle, pig, sheep, dairy and poultry farms, and in one or two cases there were specific breeding and nutrition research units. Since similar facilities exist for each of the various branches of agriculture (agronomy, horticulture, etc.), the number of farms and units under the control of the college of agriculture is considerable.

But sub-division of a subject to the extent indicated is by no means universal. Courses in breeding, nutrition and physiology will sometimes be given by the livestock production specialists, and in other cases by lecturers elsewhere within the college, e.g., in the departments of genetics and biochemistry. The latter certainly seems more rational than a situation in which courses on basic breeding principles, for example, are available in each department of animal husbandry, dairy husbandry and poultry husbandry.

Towards greater integration

I would say that the general trend is towards greater integration, due partly to the decline in the proportionate enrolment of students in Agriculture generally and partly to the reduced emphasis given to species orientated courses. The term 'animal science' is used increasingly to connote the common interest and basic principles of various livestock departments, and a single department of animal science is becoming more customary.

I was also interested to come across 'animal agriculture', signifying the mutual purpose of such departments as Animal Science, Veterinary Science, Agricultural Engineering and biological (or life sciences) to promote greater understanding of problems associated with all forms of animal production. The need for this perhaps underlines the extent to which departments have become isolated from each other as a result of specialized interests.

Now although the scope of courses, research and advisory work may be restricted for a particular department, the curriculum in Animal Husbandry (science) available to a student is very broadly based. It is axiomatic in universities in the U.S.A. that every student should receive a broad general education and at the same time be allowed considerable latitude of choice among the courses to be followed. Each entrant into Animal Husbandry is required to take the basic university courses in American thought, language and history, in social sciences, in natural sciences and in the humanities. Certain prescribed courses offered by the College of Agriculture are also

obligatory. These will usually be at a general introductory level in agricultural economics, animal production, crop production and agricultural engineering, and include basic courses in soil science, animal nutrition and plant and animal breeding.

Towards specialization

With a broad education thus secured, the animal husbandry student can choose among three or four broad areas to obtain additional knowledge. The choice varies with the university but it will most usually be from among agricultural science, agricultural business, and general agriculture or production.

The science option will be heavily weighted towards genetics, physiology and nutrition and have a high content of the relevant classical sciences. It is designed primarily for the student who wishes to pursue a more academic or research career.

The business option will include a greater proportion of economics and allied subjects. This type of curriculum seems to be increasingly in demand for entry into the servicing, marketing and distributive sections of agriculture.

The production option will include more of the species orientated courses, and place greater emphasis on technology and husbandry (with its more usual meaning). The accent once given to judging classes and selection of livestock according to type and conformation has declined, but the curriculum is still directed mainly at those who will take up livestock farming as a career, requiring some degree of technical competence and practical skills.

It is important to realize that these options are usually available whatever the main stock or product interest of the student, be it in red meat animals, dairying, poultry or meat itself. Many of the courses taken will be given by departments other than that of Animal Husbandry (or science) but they are chosen with the advice of a counsellor, or adviser, on its staff. He has considerable responsibility for welding the various courses into a cohesive programme, having regard also to the student's intellectual capacity. Otherwise a very fragmented curriculum may result, comprising as it were snippets of information drawn from the whole range of agricultural subjects. The extent of choice, however, varies at different universities, and at some the course requirement for specific options can be quite rigid. Thus it may be almost obligatory for a student to take the progressive type of curriculum favoured by English universities.

New image

At the end of a four-year degree course the Animal Husbandry graduate will have received, as a rule, a good general education, but knowledge in depth will be restricted to a relatively small area of his subject. Opinion seems to be increasingly in favour of broadening curricula, but with more emphasis on basic science training, and this is in keeping with the new image of a more scientific and more business-like agriculture presented to the schools and the public at large.

Specialization, however, is the rule at graduate level. The strength of the graduate schools, consisting of students qualifying for higher degrees, is recognized by everyone. In Animal Husbandry (science) the student, who by this time has determined his main axis of study, will be required to take a high proportion of course work, usually with a bias towards animal

breeding, or nutrition or physiology, besides carrying out a specific research task. Supporting courses offered by other departments will be prescribed, particularly if those appropriate to the main theme of research have been omitted from the curriculum followed for a first degree.

As a result of the overall training thus possible, a student of animal science is made aware of the broad horizons of his subject, receives a general grounding in science and production and finally can achieve a thorough scientific training in depth at a period of his life when maturity and responsibility have developed his faculty to make critical and appreciative appraisal.

Agriculture and veterinary medicine

My final comment is on the extent of co-ordination between colleges of agriculture and veterinary medicine in respect of animal science. The link is often just as tenuous as in Britain despite in many cases a juxtaposition of the two colleges on the same campus. The veterinary colleges, it is true, require entrants to their four-year programme to complete a two-year pre-veterinary curriculum, which is usually organized by a college of agriculture whether it is in the same or a different university. This curriculum will be based on general university and college of agriculture requirements, as in other fields of study, and will often give more emphasis to classical science than the animal science curriculum.

There is, too, considerable divergence between universities on the extent to which physiology, nutrition and genetics are taken in common by animal science and veterinary science students. It would seem logical to take advantage of the respective facilities to construct curricula with a common stem. Nevertheless a useful approach now being given effect is that a student who completes three years of an animal science curriculum and enters a college of veterinary medicine can qualify both for the degree of B.Sc. in Agriculture and that of D.V.M. in seven years. This is a dual qualification of considerable merit in any area of animal agriculture.

The author, **T. G. Boaz,** is a Senior Lecturer in the Department of Agriculture, Leeds University. He has visited agricultural colleges in ten State Universities of the U.S.A. on award of a Fellowship by the Kellogg Foundation, to study student training, curricula and research activities.

Oxford Farming Conference Report

THE papers presented to the 1963 Oxford Farming Conference in January of this year, and the discussions which followed, are printed in full in the Report and Proceedings of the Conference, copies of which are now available. They may be obtained from M. R. H. Soper, Department of Agriculture, Oxford University, Parks Road, Oxford—7*s.* (incl. postage).

Farming Cameo: Series 3

6. West Cambridgeshire

S. J. Alford

'THE soil in general may be described as a cold close clay . . . ' So said Charles Vancouver in 1794 when he was making a survey of the parishes of Cambridge to be presented to the Board of Agriculture. He was referring to one of the parishes in West Cambridge, and the impression generally of heavy, sticky soil is only too true of the bulk of the district, especially during a wet spring.

The district covers approximately 100,000 acres, stretching from the River Rhee northwards to the county boundary with the Isle of Ely, and from the River Cam westwards to Huntingdonshire and Bedfordshire.

Looking at a geological drift map, the area seems to be split in two. The southern two-thirds is dominated by a boulder clay 'plateau' which varies from 150–250 feet above sea level. This mass of undulating countryside takes up a semi-circle some six miles across on the western border. The soils here are heavy clays with a high chalk content and the farming is based on cereal growing, with particular emphasis on winter wheat. Crops with their valuable parts below ground, such as sugar beet and potatoes, are uncommon both because of the difficulties of harvesting and seedbed preparation during unfavourable weather and also the lack of casual labour in the area. The crops most commonly used to rest this land from cereals are one-year leys, beans and, along the county border, a considerable acreage of Brussels sprouts.

Drainage is a critical factor, although it is not such a problem as on the gault clay soils which lie to the south and east of this 'plateau'. These are lower and flatter than the boulder clays; they receive the drainage water from the surrounding 'hills', and have a very impervious subsoil. Despite this they are still predominantly used for cereal cropping—even if there is a rather higher proportion of land under grass.

The chalk marl occurs in places between the gault and boulder clays, as can be guessed by the orchards and the sight of the tall chimneys of a cement works.

There is another fruit tree area to the north of the Cambridge-Huntingdon Road. The soils here are very variable but mostly consist of the Oxford, Ampthill and Kimeridge clays. These form almost flat country which, in

fact, slopes gently from the base of the boulder clay hills at somewhere around 100 feet above sea level to 20 feet at the edge of the fens.

As on the gaults, drainage is the major difficulty because of the impervious nature of the subsoil and, in addition, some soils need liming at intervals. Extensive bands of valley gravel also occur among the clay soils in this area, and here again acidity can be a problem. The mixing of soil types means that the overall impression is one of lighter soils than in the south of the district, and this is borne out by the more diversified cropping. There are many more horticultural holdings and root crops are much more prevalent. This especially applies to the Lower Greensand soils around Cottenham where top fruit, soft fruit, vegetables and flowers are common crops.

The fenland of the district occupies a relatively narrow strip of land alongside the Old West River in the north and running down the side of the Cam to the east. The peat proper varies in thickness, from a few inches near the 'highland' to several feet at the bottom of Waterbeach fen in the north-east corner of the district. During cultivations, the thin peats are mixed with the subsoils which vary between clays, gravels and sands. As can be imagined, farmers on these mixtures have the same problems as those on the deeper peats, such as minor element deficiencies, plus those common on the 'highland', like acidity and drainage. They also have some which are peculiar to themselves. For example, the soil often varies considerably within areas as small as two or three acres.

With all the farming problems which occur in the district, and the proximity of the University, it seems natural that agricultural research organizations should be concentrated nearby. The University Farm is on the outskirts of Cambridge alongside the Huntingdon Road, on mainly gault and gravel soils, and practically opposite is the National Institute of Agricultural Botany. Here, not only are seed samples tested for purity and germination, but different varieties of crop plants are tested to discover their suitability or otherwise for farming conditions in the United Kingdom. Needless to say, this could not all be done on the small area of land surrounding the Institute itself, and trials are carried out on farms all over the country. Some of these are done on the N.I.A.B. farm at Lolworth, further along the Huntingdon Road.

Carrying on down the same road, the turning towards Boxworth leads to one of the Ministry's Experimental Husbandry Farms. This 850-acre farm lies mainly on the boulder clay, and both short-term experiments, like variety trials, and long-term experiments, like the cultural control of wild oats and the feeding of dairy followers, are constantly in progress.

The reader must, by now, be wondering about the stock. There are a fair number of farmers scattered over the whole area who keep pigs and poultry intensively, but the grazing animals are gradually giving way to completely arable and stockless farming. This is especially true of the fenland and the boulder clay areas where stockless farming, except perhaps for pigs, is the rule rather than the exception.

A brief summing-up of the agriculture of West Cambridgeshire could be that the area is split in two by the Cambridge-Huntingdon Road. To the south, the farming is mainly cereal growing on undulating heavy clays; to the north much more varied cropping, including market gardening, is carried out on a mixture of soils. Here, the countryside is almost flat, giving good views of the famous East Anglian sky.

C. ROBINSON
Agricultural Land Service, London

Of Buildings, Capital and Productivity

WHY do we spend money on new buildings, or changing and improving those we already have? If it were possible to have a survey of motives and a full consideration of them, I am sure it would be very profitable—even after allowing for the advantage of hindsight which is inevitably present in such investigations.

Laying out money on long-term improvements like buildings deserves more than a quick appraisal; it needs a long and careful study of the justification for it, and above all whether the supposed reasons or causes for it are really valid. It is all too easy to decide on buildings for a farm business enterprise, the existence of which is justified only by its long standing. A better method is to reflect on whether the enterprise *should* be continued at all if capital must be spent to keep it going. While it may be worthwhile now, it may not be if money has to be spent to keep it going. There could well be a more profitable way of farming, without going to any expense at all, even though it might mean relinquishing a long established system. The same can be said for adding to the scale of a production unit, for while there are cases where it can be endorsed there are many where it would be just bad business.

It's no use building upon rock if the motives are founded on quicksand, and a recent case will illustrate how easy it is to fall into a trap and base a decision to incur capital expenditure upon unsound reasons.

In this particular instance on a farm of 250 acres the owner-occupier, dissatisfied with his profits, obtained advice on his farm management, but severely limited the adviser's scope by insisting that the labour force of six should not be reduced, even though he was told that his labour input was too high. The only scope for using the excess labour seemed to be by increasing the dairy from 78 to 100 cows. The herd of 78 was milked and housed in three sheds, with no spare standings, and the next problem was where and how—and at what cost—the 22 extra cows should be housed.

The Agricultural Land Service was called in and the Land Commissioner, dubious about the idea, in turn sought the advice of a colleague trained in the application of work study to building design and estate management

problems. Together they and the N.A.A.S. farm management adviser went into the problem, and the work study man then went to work.

First he found scope for saving £1 a day on work routines in the present buildings; and it's worth noting that none of this costly waste of labour was the fault of the buildings (so often wrongly blamed). Next he studied the various methods by which the owner could gain his desired objective. The quick and easy way of building yards for 100 cows and converting an existing building to a milking parlour, at a cost of around £10,000 was clearly out of the question. All the farmer could look for in extra profit was about £1,100 from the extra 22 cows, even taking a fairly rosy view, and as they would be the reason for the expenditure they would have to bear the extra costs incurred as 'rent' on any building work. This is an important point often overlooked where existing buildings are not being used adequately and where so often a vague claim of greater efficiency in the new buildings is used as a 'set-off', to reduce the charge on the new or enlarged enterprise.

There is not sufficient space available here to tell the full story but shortly, after the most careful study of the problem, four different methods of achieving the object were evolved. Each used existing equipment but still involved a sizeable capital expenditure, ranging from £6,500 down to £4,400; and in two cases there was additional expenditure for bedding straw in loose housing—the only way in which the present buildings would accommodate the bigger herd.

The net result was that the four systems showed credit balances ranging from as little as £94 up to £421, the greatest balance being expected from a slatted floor system.

As the farmer had no liking for slatted floors for cows, he decided to abandon his idea of enlarging his dairy herd and concentrate on increasing productivity from the land. Later events proved the wisdom of this, for two of his men left after a few months. Their going would have just about coincided with the completion of the building work, which emphasizes the folly of basing a decision to spend capital upon such insecure foundations.

Another interesting feature of this case is the emphasis it gives to the scope for greater productivity in and around our farm buildings. If there is a moral in it, then it is that there are two important stages to be gone through before deciding on new buildings. The first is to examine the farm business to see if the enterprise or its enlargement can be justified. If it can, then the next thing is to study the use of existing buildings, and it is here that an unbiased and skilled opinion is essential; for we are all judges in our own cause and always find in our own favour! It is here, too, that work study techniques come into their own, since, properly used, they are the soundest way of getting to a well-founded judgment.

Only after these tests can a firm decision be taken, though even then there are many factors to take into account such as prospects for labour supply, markets and prices, to say nothing of the cost of borrowing or the income which could be got where an owner is so fortunate as to have the ready money.

A mistake in choice of crop can be eliminated, but a mistake in buildings has a substantial memorial to it. Capital expenditure in buildings is *so* permanent!

IN BRIEF

Getting rid of Effluent

Television cameras have recently been busy at Lower House Farm, Bosbury, Worcs. Until four years ago this farm of 120 acres was mainly dependent on hops, with provision for a supplementary dairy enterprise. When the farm changed hands, the hop quota was sold and the money reinvested in modernizing the dairy enterprise. A parlour and covered yard for sixty (separated from the parlour by an open collecting yard) was put in, and a self-feed silage barn was built close by.

Thought had also to be given to an efficient drainage system.

The tenant favoured pumping the effluent through irrigation equipment which could also be used for irrigating his land in a modest way from the stream. So it was decided to collect the effluent into a tank from which it could be pumped on to the land at reasonable intervals. The tank would have to contain at least ten days' flow and the effluent should be liquid enough for pumping; but it should not have to take more clean water than was needed to dilute the foul, because the bigger the tank the greater the cost.

The tank had also to be placed conveniently for pumping out the effluent on to the fields and it must be in a place to which foul drains could be diverted without great cost. The clean water from roofs was separated and discharged through the existing drainage system. The cooling water had to go with the foul drainage. This was taken, with an existing gully serving the parlour and the collecting yard area, in the opposite direction from its original flow. On the way it picked up the seepage from two cattle yards and, just before discharge into the pit, the particularly foul silage effluent was added.

The pit was dug to hold about 10,000 gallons of liquid, estimated to be adequate to take ten days' drainage of cooling water, parlour and collecting yard washings from sixty cows, plus the rainwater drained from the foul areas; in comparison with these the quantity of other foul drainage was insignificant. The ground was stable and an unlined tank was dug by excavator 4 ft 6 in. deep below the drainage entrance pipe. The bottom of the tank was 20 ft × 16 ft. It was subsequently decided that, as the effluent would be stirred up by re-circulation and the pump would have to go close to the side of the tank, one wall of the pit should be built in brick with yard-wide wing walls. This would also prevent scour in the area where the pump operated.

The cost to the tenant was some £300, for pump, rain-gun, and a comparatively small length of irrigation piping. The landlord's share for altering the drains and providing the pit was about £390, but a farm improvement grant brought it down to only £260. A fully-lined tank, possibly desirable here but essential in unstable soil, would have added another £100 to the net cost.

Drying and Storing Grain on the Floor

There is nothing new about drying grain on the floor, but it has been gathering interest recently. This, largely for two reasons: the rising cost of fully-automated single-purpose systems; and the increasing size and outputs of combine harvesters which, together with higher cereal yields, create bottlenecks at harvest time.

The capital outlay is as low as £12 per ton stored for a completely new installation, much of which may be grant aided under the Farm Improvement Scheme. There is no complicated, expensive machinery; a suitable fan and heater unit, portable lateral air ducts, and a couple of grain augers are all that is necessary. The system also offers the possibility of conditioning hay bales on a part of the floor, or the deep storage and ventilation of potatoes. It is an advantage that the stored grain can be ventilated and cooled at any time, so enabling it to be kept at rather higher moistures than is possible in unventilated stores. Add to these minimum handling of grain and easy cleaning and fumigation of the store, and one has a very attractive proposition.

Should there be a change of farm policy, the house could just as easily be used for housing stock.

The building must have a damp-proofed floor and the walls must be strengthened sufficiently to withstand the lateral pressure of the stored grain.

Mr. R. L. Wilkinson, who contributed this note, tells us that between 50 and 60 of these plants will be operational for the 1963 harvest in Leicestershire, and these will range in size from about 35 tons to 1,000 tons stored.

It is not claimed that floor drying and storage offers the complete panacea to all farm drying and storage problems irrespective of size or type, but it does hold out a solution to the farmer growing one or two types of grain, either for home consumption or for sale in bulk without further processing.

Antibiotics in Milk

Antibiotics, which provide the most effective treatment for mastitis in dairy cows, are normally passed into the milk for a period after treatment. The sale of such milk for human consumption is considered by medical experts to be undesirable because of the possibility that it could have ill-effects on the health of a few people who may be, or may become, particularly sensitive to antibiotics.

In this context the report of the Milk and Milk Products Technical Advisory Committee* will be read with interest.

The Milk Marketing Board for England and Wales, in its contract with producers, already requires them to withhold from sale milk from cows recently treated with antibiotics, and the three Scottish Boards also require or advise producers to do this. But Ministers are concerned about the proportion of milk samples taken at the dairies which have been found to contain traces of antibiotics. Dairies in England and Wales have therefore already begun to carry out and will be extending tests for antibiotics on incoming milk. Producers whose milk is found to contain antibiotics will be reported to the Milk Marketing Board and will be liable to disciplinary action.

The Scottish Milk Marketing Board also has a testing scheme in operation, and the other two Milk Marketing Boards in Scotland have been asked to make similar arrangements.

The British Veterinary Association and the Association of the British Pharmaceutical Industry have been asked to co-operate with the Government in implementing those recommendations which affect them.

**Antibiotics in Milk in Great Britain.* H.M.S.O. 1*s.* 3*d.* (1*s.* 6*d.* by post).

Maiden Strawberries for Higher Yields

By cropping maiden strawberries, planted annually and spaced closely, a three-year experiment at the Ellbridge Experimental Horticulture Station in Cornwall has shown that higher yields of good quality fruit can be obtained than by keeping the plants for 2 or 3 years at wider spacing. An average yield of 8–10 oz of fruit per plant should be obtained—60 per cent of which will be of dessert quality.

On plants left down for three years, the crop in the maiden year will give a satisfactory return, but the total yield will be lower than that from the close-planted crop, since there will be less plants per acre. In the second and third years the yield per plant will be higher than that obtained from maiden plants, but the crop is later and the percentage of dessert fruit much lower.

Besides yielding more high-grade fruit, maiden plants begin cropping earlier than two- or three-year-old plants, and so attract higher market prices than the bulk of the strawberry crop.

Compare the following figures for successive crops of Cambridge Vigour (1959–62):

	Total yield	*cwt/ac*	*Dessert quality % of total yield*
Three-year crop:			
Spaced 3 ft × 1 ft 3 in.	209	61	29
Spaced 3 ft × 2 ft	227	73	32
Spaced 3 ft × 1 ft 1st year 3 ft × 2 ft 2nd and 3rd years	231	75	32
Three maiden crops:			
Spaced 1 ft × 1 ft in 4-row beds	385	245	64

Justifying a Potato Harvester

Modern potato harvesters are far superior to earlier models and, although still not completely satisfactory, they can now work over a much wider range of soil conditions. Harvesters are expensive; nevertheless they can pay on as little as 25 acres of potatoes, as the following budget shows (the average yield on the farm concerned was 8 tons per acre).

Costs saved per acre:	£	*s.*
Picking labour saved: 30 hours @ 3*s.* 6*d.*	5	5
Repairs to elevator digger	1	0
TOTAL SAVING per acre	6	5
Extra costs per acre:		
Repairs and fuel for harvester	1	10
Depreciation and interest	4	0
TOTAL EXTRA COSTS per acre	5	10

Margin in favour of harvester . 15*s.* per acre

Fixed costs, i.e., depreciation and interest, amount to about £100 a year, which is £4 per acre on 25 acres of potatoes. This is for a harvester costing £600, kept for 8 years, with interest on capital charged at 6 per cent.

In districts where there is a shortage of casual labour for picking, the purchase of a harvester can be more easily justified than elsewhere.

This budget suggests that 20–25 acres is probably the minimum for the economic introduction of a harvester at the present time. Higher wages or increasing scarcity of labour will make mechanization still more attractive in future.

Books

Diagnostic Methods in Veterinary Medicine. 5th Edition. G. F. BODDIE. Oliver and Boyd. 30*s*.

This is a revised edition of a standard text-book in veterinary medicine, intended to introduce students to the methods of clinical investigation. I believe that the author of a text-book should be regarded with gratitude as a public servant, and the following criticisms are offered in the hope that they will be constructive.

It is a pity that the methods described are almost entirely those applicable to the individual animal and that the problem of examining groups of sick animals is ignored. If he had given more consideration to the significance of the environment and diet of animals which have fallen ill, and the epidemiology of contagious disease, Professor Boddie might have been less defeatist in his approach to the diagnosis of disease in the living pig, and have laid less emphasis on the post-mortem examination of this species.

The chapter on examination of the respiratory system obscures an already difficult subject by going into too much detail and laying too much emphasis on the use of the stethoscope. It would have been better to admit that the anatomical arrangement of the lungs of quadrupeds, largely shielded by a muscular shoulder-girdle and covered superficially by a hairy skin, precludes the minutely critical auscultation achieved by the physician examining a human chest.

Confusion arises from the indiscriminate use of the word 'acute'—sometimes in its true sense and sometimes to mean 'severe'.

Little attention is given to biopsy as an aid to clinical investigation. The anatomical drawings of the horse, ox and dog are not at all clear. Finally, one small point to help an ignorant reader from south of the Border. Just what is a 'gleety discharge'?

Veterinary students will continue to find this inexpensive book well worth buying.

F.R.S.

Weed Control Handbook. WOODFORD and EVANS. Blackwell Scientific Publications. 21*s*.

The development of the biological discipline which, for want of a better form of expression, is known as weed control, has been quite astonishing over the past twenty years. It is all the more praiseworthy, therefore, that the *Weed Control Handbook* has maintained progress with these developments. The latest edition is as comprehensive and well-presented a book of reference as can be imagined. Obviously the experience gained through publication of its predecessors has been put to good account.

The book is the product of close editorial co-operation between official bodies and commercial interests, and its aim is to provide the answer to any question about weed control. This it has achieved, in that it not only provides all the answers where an answer is known, but it laudably takes an initiative too often lacking in scientific publications and gives tentative answers and recommendations for treatment where firm information is not available. This can be of immense help to the grower who is faced with an acute and urgent problem.

One of the great merits of this publication is its layout, which provides easy access to the vast amount of information it contains. It caters equally for the farmer, the horticulturist, the forester, the agricultural engineer, the chemist and the formulator. Industrial weed control, domestic and sports ground weed control and aquatic requirements are also considered, as are administrators of agricultural schemes. It serves alike the well-informed and uninformed, the technical and the non-technical.

All in all, if the weed and or crop is named, the means of chemical control can be found; if the chemical is named, its potential is described. This is a 'must' for the library of anyone to whom 'plants out of place' present a problem.

A.F.J.W.

Types of Farming in Yorkshire. University of Leeds. 3*s*.

The three Ridings of Yorkshire contain a wide selection of English farming systems, and Leeds University has looked at some twelve of these in its latest Economics Section Report (No. 158). Included are several arable systems, dairy holdings of varying intensity, together with Dales types and milk farms of the industrial West

Riding. The farms described are, however, rather larger than the average met in practice.

The report, which relates to the year 1961/62, gives the 26 tables of results used in previous issues and these cover a large range of standards and assessments. Though the year was more favourable than 1960/61 (thanks to high potato prices amongst other things), the distribution table shows a very wide range of profits and losses both within and between groups.

In one table the authors set out the order of efficiency of the types of farm for standards of output and profits expressed in terms of land, labour, expenses, valuations and rents. Generally, farms with dairy herds tend to occupy lower places in the 'league table' unless they are operated with some intensity of cash cropping. Farms without dairy herds but more extensive in character show an expected high return for labour, though 'arable with intensive livestock' farms do well against most standards.

Expenses for almost all types of farm studied increased in 1961/62, but because output also rose, profits were greater than in the previous year in all except one group.

Unfortunately, all the data is presented on a 'whole farm' basis, which leaves no scope for looking at achievements of individual enterprises.

The report is of unique value to economists and advisers; nevertheless one wonders whether a simplified, graphic version might not fit better the label 'Farmers' Report'. Economic terminology can be indigestible! *V.C.*

Commercial Rabbit Meat Production. J. I. PORTSMOUTH. Iliffe Books. 21*s*.

Interest in the commercial rabbit industry has been increasing during the past few years, but it has been badly served for textbooks. The appearance of Mr. Portsmouth's up-to-date book is therefore to be welcomed.

It deals with the commercial production of rabbits for meat on both a large and small scale but is concerned almost entirely with the 'high cost' system. It is a little unfortunate that no mention is made of bulk feeding systems, for a good deal of interest is being shown at present in this method of feeding. The only reference to green food in the book is, indeed, the questionable statement that excessive amounts of green food produce a darker meat than does concentrated feeding.

Separate chapters deal with Breeds—although the emphasis is now shifting to hybrids rather than exhibition type breeds; Breeding, including both theory and practice, and Housing, in which the principles of good housing are excellently laid down. A chapter on Nutrition and Feeding unfortunately gives insufficient information for a producer to utilize the different foods available, unless he happens to purchase all his foods as pellets. General management is adequately covered but in discussing marketing, a good deal more could have been said about the importance of producer groups and their working.

The Costs and Returns chapter, perhaps the one which will most greatly assist the potential rabbit farmers, mentions only one system of rabbit production. It may therefore be a little misleading, for many of the modern producers have established units at far lower costs than those quoted. (It is perhaps only fair to say that some units have cost more!)

The Diseases section of such a book is always very difficult to write. The introduction is well done, but the selection of diseases for description is not. For example, no mention is made of pneumonia, or indeed of any respiratory condition apart from snuffles, although they together form one of the most important groups of diseases; yet space is devoted to the rare skin and ear mange.

Apart from these faults, however, the book can be strongly recommended to all interested in the commercial exploitation of the domestic rabbit. There are 22 photographs, most of them excellent, and 14 text figures. *J.C.S.*

Ten Years of Market Gardening. R. R. W. FOLLEY and A. R. HUNT. Wye College. 3*s*.

The ten years 1950–60 were eventful for market gardeners. This report, the third in a series, is a business study of some small-scale market gardens covering that period.

The authors present a financial picture of the years under review, discuss practical steps for improvement, and give a frank, if a little pessimistic, forecast.

During the 'easy money' period of the 1950s, small growers were beset by rising costs and stable prices. Their main defence was to cut costs, particularly labour.

In spite of the 65 per cent rise in the agricultural wage and increases in costs generally, expenditure per acre was held down to a level only 18 per cent higher at the end of the ten years than at the

beginning. Revenue per acre increased by 12 per cent in the same period.

But the purchasing power of vegetables fell. Cost cutting cannot go on for ever; therefore if that trend is likely to continue, some other approach will be necessary.

The final part of the report looks towards the long-term future of the small horticultural business. Increased chemical control, intensive management and reinvestment of profits may well bring about major changes, provided the individual outlook of the small grower does not prevent him from recognizing economic pressure.

Copies of the report may be obtained from the Secretary, Dept. of Agricultural Economics, Wye College, Ashford, Kent.

Shell Shilling Guide to Berkshire.

The author, in remarkably few words, has created a masterpiece of vivid and poetic description. It should whet the appetite of any would-be traveller seeking an afternoon's enjoyment, either in the heart of England's downland or beside meandering rivers and wooded dells, with occasional historic country towns thrown in for good measure.

The presentation is excellent, and one can forgive minor geographical inaccuracies; for instance most Berkshire men know that the main line to Bristol runs through the Vale of the White Horse and not the Kennet Valley. Perhaps this can be overlooked as poetic licence, as must be the remarks about pigs which seem to imply a county teeming with Berkshire sows when to find one would be like looking for a needle in the proverbial haystack.

The opening pages describe a tour around the perimeter of Berkshire, followed by several sweeps across the centre of the county depicting beauty spots and places of outstanding interest, with delightful references to folk-lore.

Country houses and gardens open to the public are listed, as well as books of interest. A number of well-chosen photographs emphasize the grandeur of the countryside and the architectural majesty of its finer buildings.

The map which occupies the centre pages seems rather crude and lacks detail. It does not do justice to the rest of the publication, and would have been more interesting had it shown the physical characteristics of the county, or been presented in a bold graphic form.

The concluding pages offer a concise gazetteer which mercifully does more than merely list the churches and effigies therein. Here we find interesting asides, such as reference to the farm at Coombe whose owner is responsible for maintaining the gibbet, and the Hungerford Hock-tide with its tutti-men.

This is obviously a booklet which the casual visitor to Berkshire cannot afford to be without and which even the inhabitants will find immensely interesting. It may be bought only through Shell and BP service stations. *J.C.R.*

Africa and Irrigation. Wright Rain Ltd. 42*s*.

An international symposium on irrigation was held in Salisbury, Southern Rhodesia, in August, 1961, and this is a report of the proceedings.

Many of the papers presented dealt with irrigation problems, water supplies and food production, specifically in Africa. Others were of more general interest. Reports were also given on experiences and experiments in irrigating a wide range of vegetable crops in Australia and Southern Rhodesia, sugar cane, coffee and citrus fruits in Africa, and cotton in the U.S.A.

A number of speakers discussed problems associated with the design and operation of sprinkler systems, and the notes on these will have a wider appeal. The mechanical aspects of system design are dealt with very fully.

In addition, there is up-to-date information on plant/soil relationships, and on the use of instrumentation and weather data for estimating irrigation need and the times of irrigations. Some of the information given in these sections is not available in print elsewhere. *J.J.N.*

Handbook of Practical Nutrition and Feeding of Domestic Animals. D. C. MAPLESDEN. Baillière, Tindall and Cox. 36*s*.

Written by a veterinarian for veterinarians, this publication is intended as a reference manual on some applied aspects of animal nutrition.

Packed into its 186 pages are 11 chapters devoted to the feeding and nutrition of both dairy and beef cattle, sheep, horses and pigs, as well as of cats and dogs. Nutrient metabolism and nutritional disorders are covered in special sections, and tables giving the approximate composition of a variety of common feedingstuffs are included as an appendix.

The author does not pretend that it is a scientific treatise, either in content or style of presentation, and references to some forty 'selected readings' are given for the benefit of readers requiring further information.

The handbook contains useful data on fundamental aspects of nutrition and dietary requirements, and gives considerable prominence to the use and role of minerals, vitamins and other additives in animal feeding. Various husbandry practices are discussed in some detail, and examples are quoted of the types of rations fed to different classes of livestock. Essentially these are dealt with in the context of American or Canadian conditions and are not necessarily applicable to British conditions.

The point is illustrated in the restricted inclusion of barley in compound milk production rations (about 20 per cent) and the complete elimination of groundnut as a protein supplement in preference to linseed, soya or cottonseed. Again a deficiency of iodine appears to present a real threat to most livestock enterprises and the use of an appropriate mineral supplement is almost universally advocated; similarly with cobalt where ruminants are concerned.

By British standards it is hard to understand the recommendation given in the section on dairy cattle that 1 lb concentrates should be fed for every 3–5 lb milk produced, and such statements as 'This is likely due to the increased release of oxytocin by calves nursing their dams several times daily' is sure to evoke speculation if not some amusement! These are, perhaps, examples of clarity being sacrificed for brevity.

A number of detracting errors have been overlooked by the proof-reader, typical of which are statements to the effect that protein on average contains 15 per cent nitrogen, and that the nitrogen content of urea is 262 per cent that of protein. More in keeping with the facts are values of 16 per cent and 292 per cent respectively.

Although compiled primarily with veterinary practitioners in mind, the book contains much of interest to advanced students of animal nutrition and to those variously concerned with the feeding of farm livestock. *W.L.*

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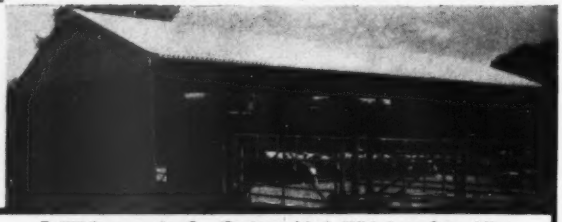

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